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Anatomy



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Version 5.3

Corrected, Updated, Lighter

PLAB 1 Keys is for **PLAB-1** and **UKMLA-AKT** (Based on the New MLA Content-Map)

With the Most Recent Recalls and the UK Guidelines

ATTENTION: This file will be updated online on our website frequently!

(example: **Version 2.7** is more recent than **Version 2.6**, and so on)

Key
1

Important Nerve Injuries with the Resulted Defects			
	Motor	Sensory	Typical mechanism of injury & notes
Musculo-cutaneous nerve (C5-C7)	Elbow flexion (supplies biceps brachii) and supination	Lateral part of the forearm	Isolated injury is rare usually injured as part of brachial plexus injury

Axillary nerve (C5, C6)	Shoulder abduction (deltoid muscle)	Inferior region of the deltoid muscle	Humeral neck fracture/dislocation Results in → flattened deltoid
Radial nerve (C5-T1)	Extension (forearm, wrist, fingers, thumb)	Small area between the dorsal aspect of the 1 st and 2 nd metacarpals	Humeral midshaft fracture Palsy results in → wrist-drop
Median nerve (C6-T1)	LOAF muscles Features depend on the site of the lesion: wrist: paralysis of thenar muscles, opponens pollicis elbow: loss of pronation of forearm and weak wrist flexion	Palmar aspect of lateral 3½ fingers	Wrist lesion → carpal tunnel syndrome

Ulnar nerve (C8, T1)	Intrinsic hand muscles except LOAF Wrist flexion	Medial 1½ fingers	Medial epicondyle fracture Damage may result in → claw hand
Long thoracic nerve (C5-C7)	Serratus anterior		Often during sport e.g. following a blow to the ribs, lifting weights . Also, a possible complication of mastectomy Damage results in → winged scapula

✓ LOAF muscles:

- Lateral two lumbricals
- Opponens pollicis
- Abductor pollicis brevis
- Flexor pollicis brevis

A young man presents with sudden pain in the chest while lifting weights. He is unable to lift the arm above the head, difficulty in abducting his left hand beyond 90, when the arm is stretched out against resistance, the scapula is noticed to be prominent. Injury to which of the following nerves is affected?

A. Dorsal scapula nerve

B. **Long thoracic nerve**

C. Posterior interosseus nerve

D. Axillary nerve

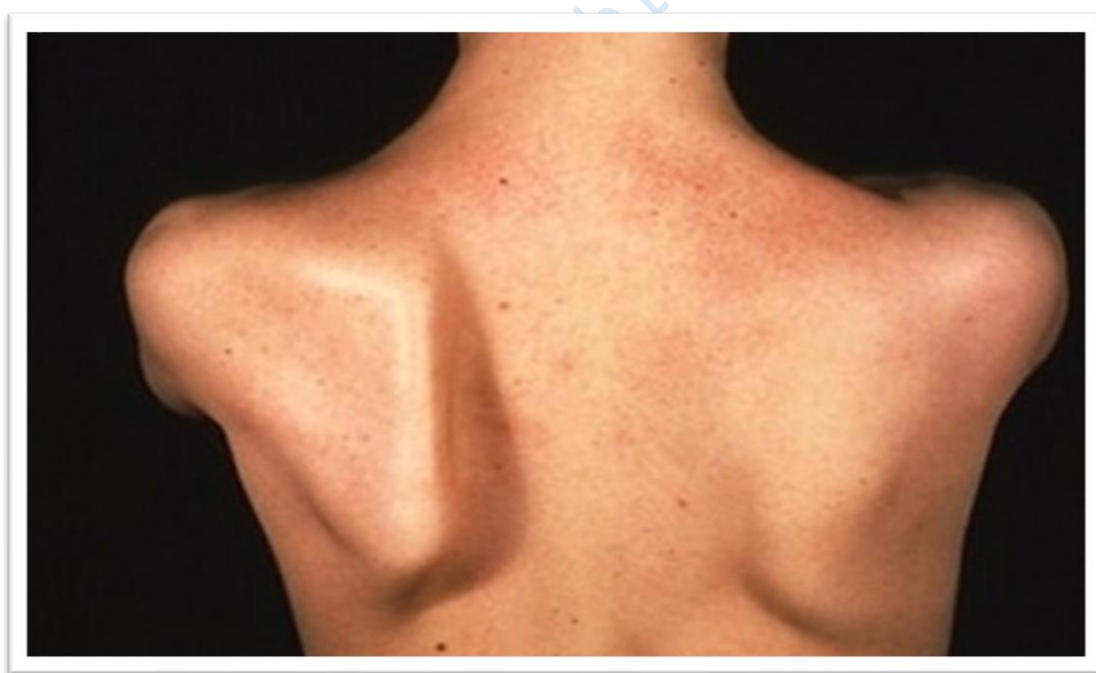
E. Thoracodorsal nerve

Long thoracic nerve (C5-C7)

Serratus anterior

Often during sport e.g. following a blow to the ribs, lifting heavy objects. Also, possible complication of mastectomy

Damage results in a **winged scapula**



When **long thoracic nerve** “that innervates **serratus anterior** muscle” is injured:

✓ The pain will be more severe on contralateral tilting of head (i.e. if the **right** scapula is affected, tilting the head to the **left** increases the pain”.

✓ On performing push-ups against a wall, the scapula winging increases.

An important differential Dx:

✓ Injured **Accessory nerve** (the 11th Cranial Nerve)

(e.g. during [a surgery of the POSTERIOR Triangle of Neck](#))

→ **Dropped Scapula** = **Unable to move the shoulder.**

✓ On abducting the arm at the shoulder level, the winging increases.

✓ The accessory nerve is the CN XI (the 11th Cranial Nerve) → supplies [trapezius](#) muscle and sternocleidomastoid.

An important differential Dx:

(e.g. humeral neck fracture, or after [shoulder dislocation](#))

Injury to **Axillary nerve** may occur, leading to:

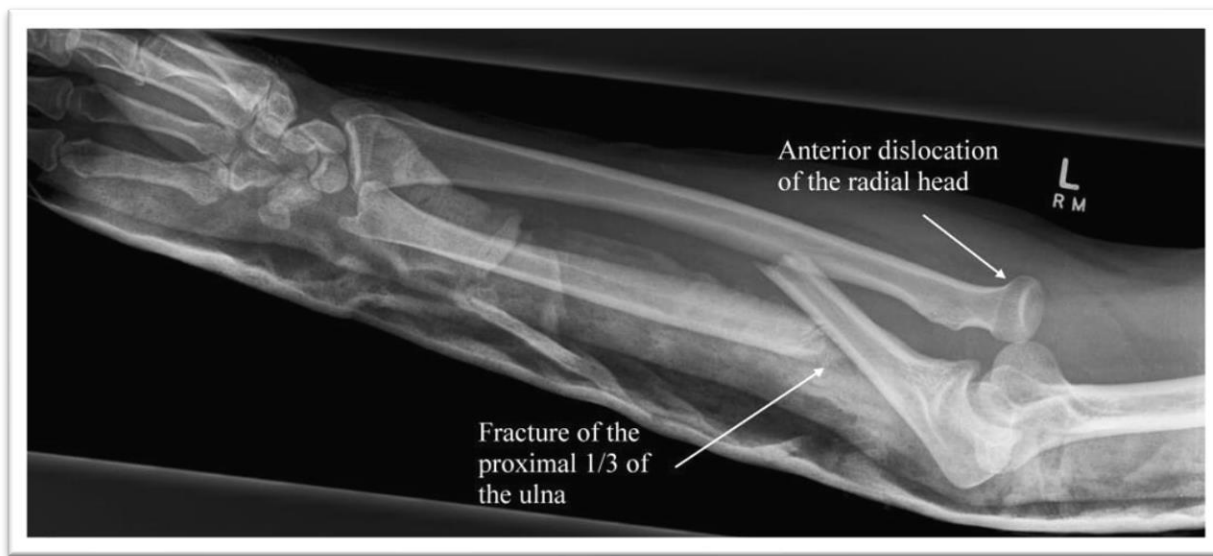
→ **Paralyzed deltoid muscle + Loss of Sensation of the skin over deltoid.**

Key
2**Key Phrases for Nerve Damage for PLAB 1****Wrist Drop****Radial Nerve****Foot Drop****Common Peroneal
Nerve or
Sciatic Nerve****Claw Hand****Ulnar Nerve****Paraesthesia of thumb, index, MIDDLE finger****Median Nerve****Paraesthesia of little finger + ring finger****Ulnar nerve****Paraesthesia of the "dorsal" aspect of the THUMB ±
"dorsal" area between 1st (Thumb) and 2nd (Index) fingers****Radial Nerve****Numbness on Superior aspect of upper arm just
below shoulder joint****Axillary Nerve****Numbness over deltoid, Paralyzed deltoid**

Fibular Neck Fracture	Common Peroneal Nerve
Femur Neck Fracture	Sciatic Nerve
Acetabular Fracture	Sciatic Nerve
Humeral <u>Shaft</u> Fracture	Radial Nerve
Humeral <u>Neck</u> Fracture	Axillary Nerve
Winged “prominent” Scapula ↑ winging/ dropping on pushing a wall	Long thoracic nerve
Dropped Scapula ↑ winging/ dropping on abducting the arm at the shoulder level.	Accessory nerve (11th CN)
Monteggia Fracture: (Anterior Dislocation of the head of radius + Fracture of the proximal 1/3 of the Ulna)	Radial Nerve

**Paraesthesia and impaired sensation in both hands
(Glove distribution)**

Peripheral Neuropathy



The **Monteggia fracture** is a **fracture** of the proximal third of the ulna with dislocation of the proximal head of the radius → **Radial Nerve**.

Other Clinchers for Anatomy:

■ Ulnar Nerve (C8-T1) injury

- **Claw hand** →

(Due to ulnar nerve damage causing paralysis of the lumbricals. A claw hand presents with a hyperextension at the metacarpophalangeal joints and flexion at the proximal and distal interphalangeal joints of the 4th and 5th fingers).

- Also, **loss of sensation** over the **5th finger** (the **little finger**) + a variable area of the **4th (ring)** finger both dorsal and palmar aspects.

■ Radial Nerve (C5-T1)

- Motor supply to the **Extensors** of the (thumb, fingers, wrist and forearm).

If damaged → **Wrist Drop**

- Radial nerve can be compressed against the operating table (medial aspect of the arm) during an operation →

(Saturday Night Palsy).

- Also, **Crutch palsy** (a compression against the **spiral groove** on the medial aspect of humerus).
- Injury to the **Radial nerve** can also lead to **sensory loss** of the dorsal aspect of the **THUMB** ± a small area over the dorsal aspect between **1st and 2nd fingers**.

Notes on Fingers Flexors

- Unable to **flex** the “**Proximal**” interphalangeal (IP) joints AND Metacarpophalangeal (**MCP**) joint, but able to flex the distal IP joint →
Flexor Digitorum Superficialis.
 - Unable to **flex** the “**Distal**” interphalangeal joints →
Flexor Digitorum profundus.
-

Notes on Fingers Extensors

- **Extensor Digitorum**

→ (Extends the middle three fingers: index, middle and ring).

- **Extensor Digitorum**

→ (Extends all fingers at **MCP** and **IP** joints).

Pollicis = Thumb

- **Extensor Pollicis Longus**

→ (Extends the **Thumb** at the interphalangeal joints "**IP**").

N.B. **Full extension of a thumb** is achieved by **extensor pollicis LONGUS**.

N.B. Long=IP

- **Extensor Pollicis Brevis**

→ (Extends **Thumb** at Metacarpophalangeal **MCP** joints)

Key 3 ■ During a **laparoscopic cholecystectomy**, the **midline** structure that is pierced is → **Linea Alba**.

■ While performing laparoscopy, the anatomical structure(s) to be pierced while inserting a port at the **midway point between umbilicus and anterior superior iliac spine** is

→ **Internal oblique muscle and external oblique aponeurosis**.

■ While performing a laparoscopic cholecystectomy, the first anatomical structure(s) to be pierced while inserting a port at the **midway point between Anterior midline and mid-axillary line** is

→ **External oblique aponeurosis and Internal oblique muscle**.

■ When inserting a chest drain into the 5th ICS anterior to mid-axillary line, not only the vessels (**VAN**) intercostal **V**ein, **A**rtery and **N**erve can be pierced, but also **intercostal MUSCLE** is liable to be pierced

Proximal Biceps Tendon Rupture:

Muscle bunches up in the distal arm → Popeye appearance.

Distal Biceps Tendon Rupture:

Single traumatic event (e.g. flexion against resistance), sudden sharp tearing sensation, painful swollen elbow, weakness of flexion and supination.

"The patient feels that something in the cubital fossa has ruptured"

→ Biceps Tendon Rupture

Other Notes:

- **De Quervain's disease**: (= washer woman = mammy thumb): Pain under root of thumb (**tenosynovitis**).
- **Tennis elbow** = **lateral epicondylitis** → affected **wrist extension**, mainly due to overuse e.g. in tennis players.
- **Golfer's Elbow** = **Medial epicondylitis**: all flexors to fingers and pronator are affected. Seen in baseball players, construction injury, plumber injury.

Key
4

Points on the Nerves of the Eye

LR6 (SO4) O3

- Lateral Rectus muscle → supplied by **Abducens** Nerve (6th CN).
- Superior Oblique muscle → supplied by **Trochlear** Nerve (4th CN)
- Oculomotor Nerve (3rd CN)

O : T : A Law

(3rd, 4th, 6th)

Same, Opposite, Same side

- **Oculomotor (3rd)**

✓ Controls most of the eye muscles, constricts the pupils, innervates the Levator palpebrae superioris.

✓ Its injury leads to →

Dilated pupil (Mydriasis), Ptosis (On the **Same** side),

Others: outward gaze, diplopia

Also, in **3rd nerve palsy** → down and out appearance (**on looking forwards, the affected eye deviated inferiorly and laterally**).

- **Trochlear (4th)**

Diplopia on **Downward** gaze ((**Opposite** side)) “i.e., **Vertical Diplopia**”

e.g., while climbing the stairs, if he looks at the left and sees double

→ then the lesion is on the right.

The affected muscle → **Superior obliques (SO4)**.

- **Abducens (6th)**

Diplopia on **Lateral** gaze ((**Same** side). “i.e. **Horizontal Diplopia**”

If he looks at left and sees double → then the lesion is on the left ((**Same** Side)).

Remember O:T:A

O (Oculomotor) 3 rd CN	T (Trochlear) 4 th CN	A (Abducens) 6 th CN
Same side	Opposite side	Same side
Dilated pupil, ptOsis	Diplopia on Downgaze . The affected muscle → <u>Superior obliques (SO4)</u> . (Vertical diplopia)	Diplopia on Lateral gaze. The affected muscle → <u>Lateral rectus (LR6)</u> . (Horizontal diplopia)
LR6 (SO4) O3		

- Lateral Rectus muscle → supplied by Abducens Nerve (6th CN).
- Superior Oblique muscle → supplied by Trochlear Nerve (4th CN)
- Oculomotor Nerve (3rd CN)

O : T : A Law

(3rd, 4th, 6th)

Same, Opposite, Same side

_____, Vertical, Horizontal diplopia.

OTA

Oculomotor (3rd), Trochlear (4th), Abducens (6th)

Same, Opposite, Same

Ptosis, Downward gaze, Lateral Gaze

Example (1)

After getting a hit on his face, a boy sees double when climbing the stairs. He also sees double when looking to the right side.

✓ The affected nerve is → Left Trochlear nerve.

Climbing the stairs = “downward gaze” → Trochlear → **opposite** side → diplopia when looking to the **Right** → the **Left** trochlear nerve is affected.

✓ The affected muscle → Superior obliques (SO4). (vertical diplopia).

Example (2)

A man presents complaining of diplopia while climbing down the stairs. What is the likely affected nerve?

Climbing the stairs = Downward gaze.

Diplopia on Downward gaze → **Trochlear Nerve** (4th CN). Opposite.

Example (3)

A patient with right eye ptosis, outward gaze and diplopia.

The likely affected structure → **Right Oculomotor nerve** (3rd CN)

Remember: Pt^Osis → ^Oculomotor. (Same Side).

Example (4)

A man complains of double vision when looking to the right.

✓ The likely affected nerve is → **Right Abducens**

Diplopia on lateral gaze → Abducens nerve (Same Side)

✓ The affected muscle → Lateral rectus (LR6). (Horizontal diplopia).

Deswaq

O: T: A Rule for Eye Muscles by plab1keys.com

O (Oculomotor) 3rd CN

Same side

Dilated pupil, ptOsis

T (Trochlear) 4th CN

Opposite side

Diplopia on **Downgaze**

A (Abducens) 6th CN

Same side

Diplopia on **Lateral** gaze

Example: After getting a hit on his face, a boy sees double when **climbing the stairs**. He also sees double when looking to the **right** side.

The affected nerve is → **Left Trochlear** nerve

Climbing the stairs = "downward gaze" → Trochlear → opposite

Example: A man complains of double vision when looking to the right. The likely affected nerve is → **Right Abducens**

Diplopia on lateral gaze → Abducens nerve (Same Side)

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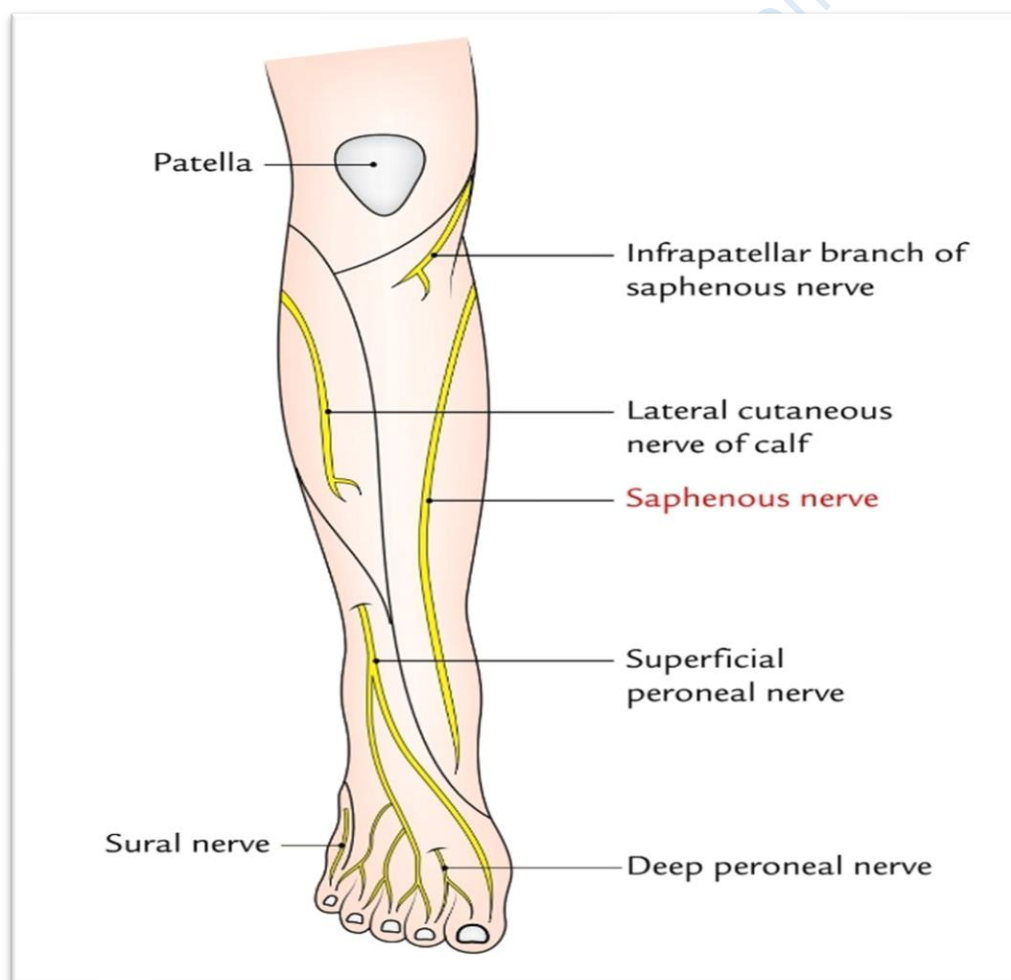


Key
5

Sensory innervation of the medial and lateral Foot

- Loss of sensation in **MEDIAL Foot** → **Saphenous Nerve**.

- Loss of Sensation in **LATERAL Foot** → **Sural Nerve**.
 - Foot Drop: Common Peroneal Nerve.
- **Saphenous Nerve** is the Largest Cutaneous branch of the Femoral Nerve. It is purely Sensory. It supplies the Medial Foot. It can be injured during Varicose vein surgery, vein harvest for bypass surgery, or Knee arthroscopy.



- Key 6
- ✓ The order of the Intercostal Vessels (VAN), Vein, then Artery, then Nerve.
 - ✓ Any of these vessels can be pierced during chest drain insertion.
 - ✓ In addition to VAN, intercostal muscles can also be pierced during chest drain insertion.

They are located at the inferior border of a rib. Therefore, the insertion of the chest-drain "intercostal tube" should be at the superior border of a rib.

The site of Chest Drain → the safe triangle, locates at:

(5th Intercostal space, slightly anterior to the mid-axillary line).

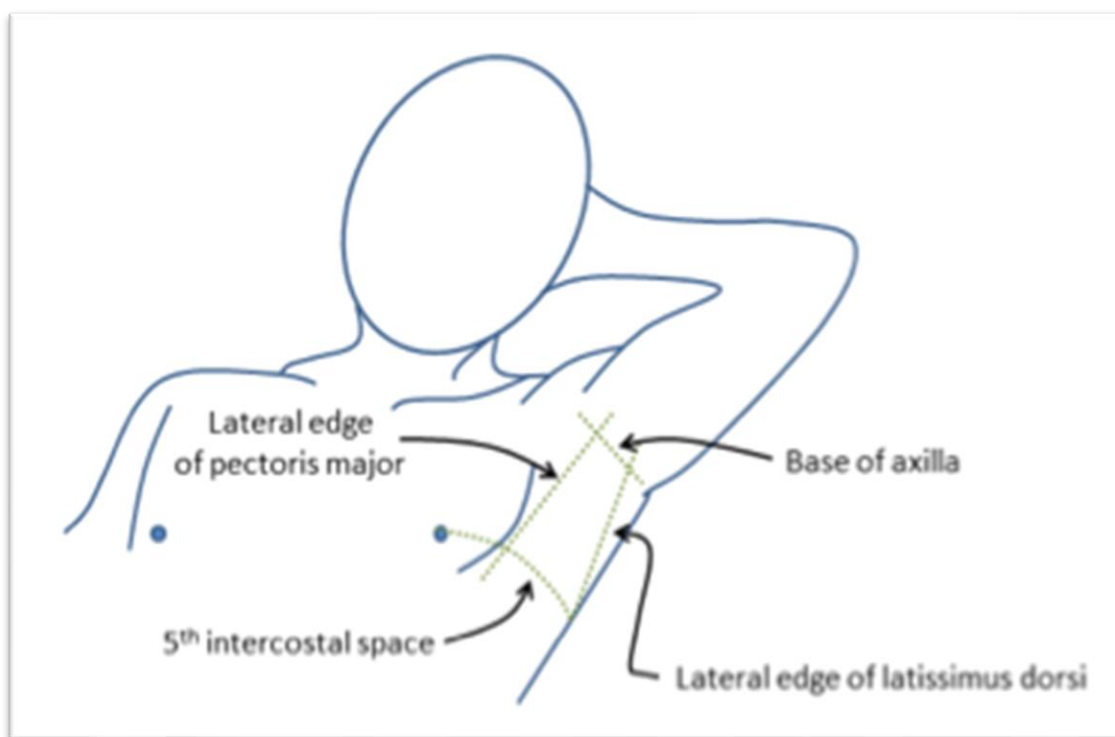
■ **The boundaries of the safe triangle** (The site of insertion of intercostal tube- Chest Drain) are:

Anteriorly: Pectoralis Major.

Posteriorly: Latissimus Dorsi.

Superiorly: Base of Axilla.

Inferiorly: 5th intercostal space.



Key
7

Notes on Lymphatic Drainage

- Gonads (Ovary, Testis) → Para-aortic LNs
- Skin (Perineum, Scrotum, Vulva) → Superficial inguinal LNs

Tongue:

- Tip of tongue: Submental LNs.
- Anterior 2/3 of tongue: Submandibular LNs.
- Posterior 1/3 of tongue: Jugulo-Omohyoid (Deep Cervical LNs).

- LNs of **Posterior Oropharynx** → **Deep Cervical** LNS or (= **Jugular** LNs)
- The skin over the **Medial Malleolus** drains into the **inguinal LNs**.
- The skin over the **Lateral Malleolus** → **popliteal** LNs → **inguinal LNs**.

Example

A woman with **ovarian cancer**, the likely LNs to be involved are:

→ **Para-aortic LNs**

Example

A patient with a non-healing ulcer over the medial malleolus. What are the draining lymph nodes?

→ **Inguinal LNs**.

• **Lymph nodes drainage (a different collection):**

- Skin (scrotum, vulva, perineum) → Superficial inguinal LNs

- Drain all below umbilicus → Superficial inguinal LNs, except Gonads and Lateral foot
- ✓ Gonads (testis, ovaries) → Para-aortic LNs
- ✓ Lateral foot → Popliteal LNs
- Deep lymphatics of glans, clitoris → External iliac LNs

Key
8

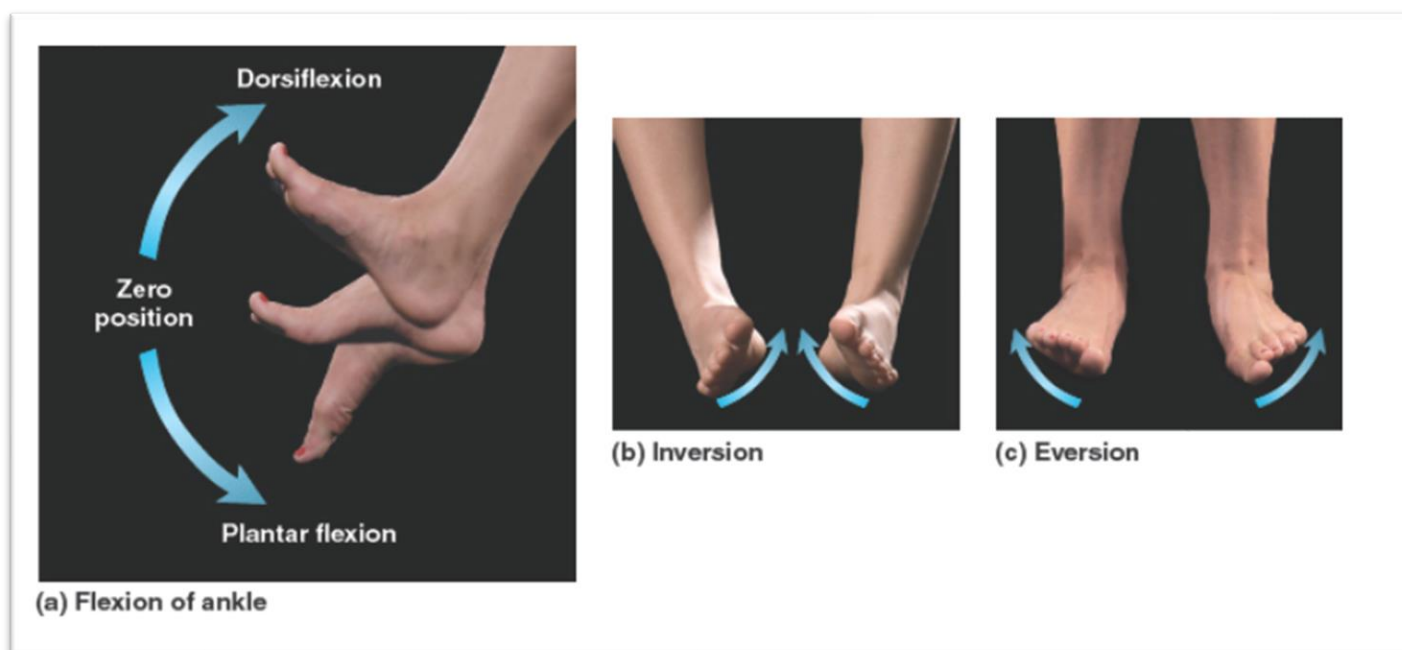
- **Peroneal Strike:**

A blow just below knee → Temporary loss of motor and sensory function (from 30 seconds to 5 minutes) → **foot drop** → the affected nerve is

→ **Common Peroneal Nerve**

Remember that, the two motor branches of the common peroneal nerve:

- **Superficial peroneal nerve** → Supplies the **lateral** Compartment of leg → evert the foot.
- **Deep peroneal nerve** → Supplies the **Anterior** Compartment of the leg → dorsiflex the foot.



Key
9

- **Extensor Digitorum** → (Extends the middle three fingers: index, middle and ring).
- **Extensor Digitorum** → (Extends all fingers at MCP and IP joints).
- **Extensor digiti minimi** → (Extends the little finger).
- **Extensor indices** → (Extends the index finger).
- **Extensor Pollicis** → (Thumb)

- **Extensor Pollicis Longus** → Extends the **Thumb** at the interphalangeal joints **IP**.

N.B. **Full extension of a thumb** is achieved by **extensor pollicis LONGUS**.

N.B. Long=IP

- **Extensor Pollicis Brevis** → Extends **Thumb** at Metacarpophalangeal **MCP** joints.

Q) A patient with an injury on his hand cannot extend the distal phalanx of his ring finger. What is the affected muscle?

The ring finger has no specific muscle like in the thumb (pollicis) for instance; therefore, pick the bulk one (**Extensor Digitorum**) which extends index, middle and ring fingers.

Don't get confused with FLEXORS!

- Unable to flex the "**Proximal**" interphalangeal **IP** joints AND Metacarpophalangeal (**MCP**) joint

→ **Flexor Digitorum *Superficialis***.

- Unable to flex “**Distal**” interphalangeal joints

→ **Flexor Digitorum *profundus***.

Other Clinchers for Anatomy:

Ulnar Nerve (C8-T1) injury

- **Claw hand** → (due to ulnar nerve damage causing paralysis of the lumbricals. A claw hand presents with a hyperextension at the metacarpophalangeal joints and flexion at the proximal and distal interphalangeal joints of the 4th and 5th fingers).
- Also, **loss of sensation** over the 5th finger (the **little finger**) + a variable area of the 4th (**ring**) finger both dorsal and palmar aspects.

Radial Nerve (C5-T1)

- Motor supply to the **Extensors** of the (thumb, fingers, wrist and forearm).
If damaged → **Wrist Drop**
- Radial nerve can be compressed against the operating table (medial aspect of the arm) during an operation → (**Saturday Night Palsy**).

- Also, **Crutch palsy** (a compression against the **spiral groove** on the medial aspect of humerus).
- Injury to the **Radial nerve** can also lead to **sensory loss** of the dorsal aspect of the **THUMB** ± a small area over the dorsal aspect between **1st** and **2nd** fingers.

Key
10

☐ **Short saphenous Vein:**

The only vein that runs on the LATERAL aspect of the leg.

☐ In contrast: The **long (great) Saphenous Vein** runs on the MEDIAL aspect of the angle.

☐ **Do not get confused with NERVES:**

Saphenous nerve runs medially, Sural nerve runs laterally.

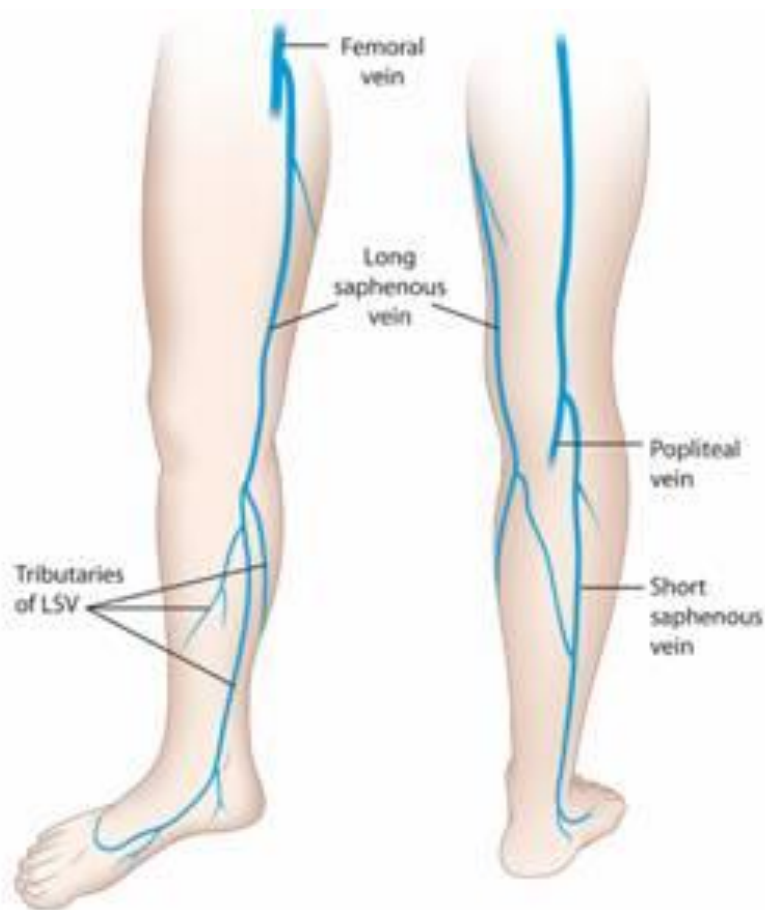
☐ So, on the Medial aspect of a leg

→ **Long (great) Saphenous Vein + Saphenous Nerve.**

☐ On the Lateral aspect of a leg

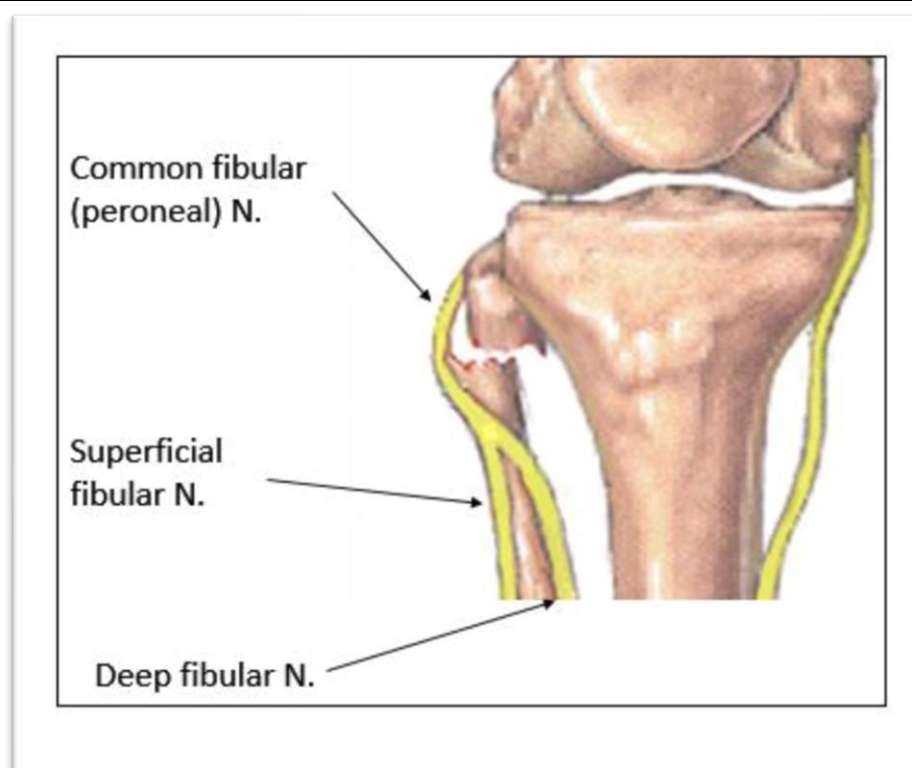
→ **Short Saphenous Vein + Sural Nerve.**

■ Q) Varicose veins on the lateral aspect of the leg. The affected vein is
→ **Short Saphenous Vein.**



Key
11

- Fracture of the **neck** of the **Fibula** leads to an injury of →
Common peroneal nerve → **Foot drop**
(inability to evert or to dorsiflex the foot)



- Fibular Nerve “Common peroneal nerve” supplies biceps femoris (which flexes the Knee).
- It, also, gives **TWO MOTOR** branches:

Superficial Fibular (Which innervates the **Lateral** compartment of the leg, and its injury causes inability to **evert** the foot).

Deep fibular nerve (Which innervates the **Anterior** compartment of the leg and also extends the digits, and its injury causes inability to **dorsiflex** the foot).

The injury of Common peroneal Nerve leads to **FOOT DROP** (No dorsiflexion, No eversion of foot).

- The Common peroneal nerve gives also **FOUR SENSORY** branches:

Sural communicating → (lower posterolateral leg).

Lateral Sural Cutaneous → (Upper Lateral Leg)

Superficial Fibular (peroneal) → (Skin of Anterolateral leg except the skin between first and second toes)

Deep Fibular (peroneal) → (Skin between the first and second toes)

Key
12

C8 radiculopathy

Affects **thumb abduction and extension**, causes **ulnar deviation of the wrist**, and causes paraesthesia of a thin area on the forearm which runs down to include the little finger.

T1 Radiculopathy

Affects **Fingers Abduction and Adduction**, Pain and Paraesthesia along the affected nerve.

To Summarise:

- Thumb movement weakness, Wrist Ulnar deviation, Little finger Paraesthesia → **C8 nerve root** injury.
- Fingers' Abduction and Adduction weakness → **T1 nerve root** injury.

- Loss of Thumb Sensation, Loss of elbow flexion → **(C5,6) Erb's palsy**

The motor function of the nerve roots of an upper limb

C5, C6, C7, C8

Flex, extend, extend, flex

elbow, wrist, elbow, fingers

C5	C6	C7	C8
Flex	Extend	Extend	Flex
elbow	wrist	elbow	Fingers

Adduct and Abduct Fingers → T1

N.B. There is nothing called (C8 Vertebral injury), but there is (C8 Nerve root lesion) which is manifested by impaired thumb movement + Wrist ulnar deviation + Little finger paraesthesia.

C6: Thumb / C7: Middle three fingers / C8: little (Pinky) finger.

Example (1)

A patient presents with pins and needles sensation of the skin over the lateral posterior area of the distal forearm including the little finger, weakness of thumb extension, wrist ulnar deviation and slight loss of the muscle of the affected hand.

The likely affected structure → **C8 Root**.

Example (2)

A man complains of pain on the medial side of his right forearm. There is weakness of finger abduction and adduction as well as thumb adduction. No abnormality with finger flexion. The right-hand muscles are slightly atrophied.

The likely affected structure → **T1 Nerve Root Injury**

Example (3)

A 55 YO man presents complaining of a neck pain, left arm discomfort and left-hand weakness. On examination, he has weakness in abducting and adducting the fingers of his left hand. MRI reveals a left-sided disc herniation in one area of spinal cord. What is the likely affected nerve root?

The likely affected structure → **T1 Nerve Root Injury**

Example (4)

A 30 YO man has neck pain that radiates to his left shoulder and left middle finger. He also has decreased sensation on his left index and middle fingers. Left arm shows reduced triceps reflex. He also has difficulty straightening his left elbow.

What is the most likely affected nerve root?

[C5 / C6 / **C7** / C8 / T1]

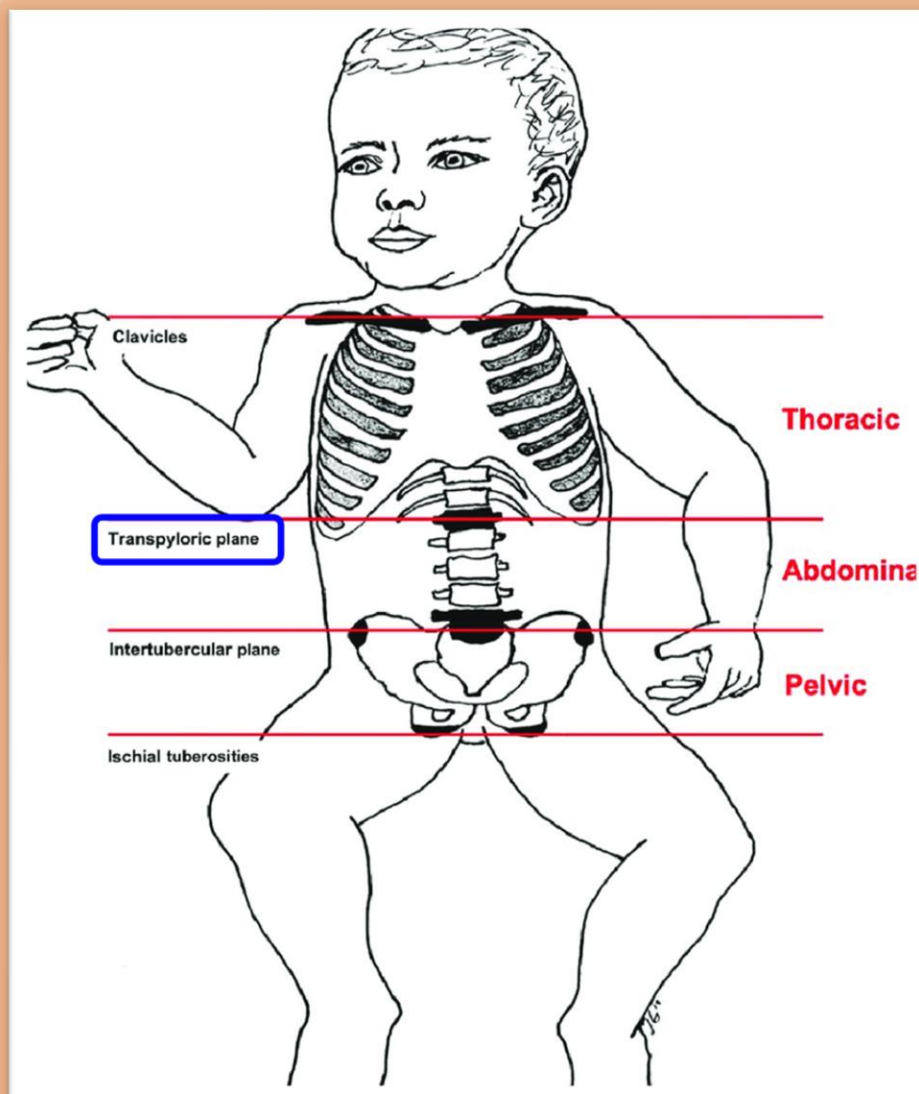
He has a problem on extending his elbow. Thus → C7 is most likely affected.

C5	C6	C7	C8
Flex	Extend	Extend	Flex
elbow	wrist	elbow	Fingers

Key
13

Transpyloric plane

Transpyloric plane (or Addison's plane) is a transverse line located midway between **sternal notch** and **symphysis pubis**.



■ The Important **Transpyloric Plane**

= The level of **L1**

= The level of the **9th Rib** "its anterior end"

= The level of the pylorus of the stomach = Fundus of the Gall Bladder.

■ So, the TIP of the 9th costal cartilage correlates the Fundus of GB.

The level of 9th CC → Many structures

But the (Tip) of 9th CC → (Fundus) of GB

Structures at the level of L1 → Transpyloric plane

- 9th Costal Cartilage,
- GB fundus,
- Stomach pylorus,
- Kidney hilum,
- SMA (Superior mesenteric artery),
- Celiac trunk.

Key
14

- Perforation of a Posterior (Gastric) Ulcer (Fundus or Body of Stomach)
 - accumulation of pus in the **Lesser Sac** (behind the stomach)
 - Abscess formation that passes to the peritoneal cavity through the Foramen of Winslow
 - Generalized Peritonitis.

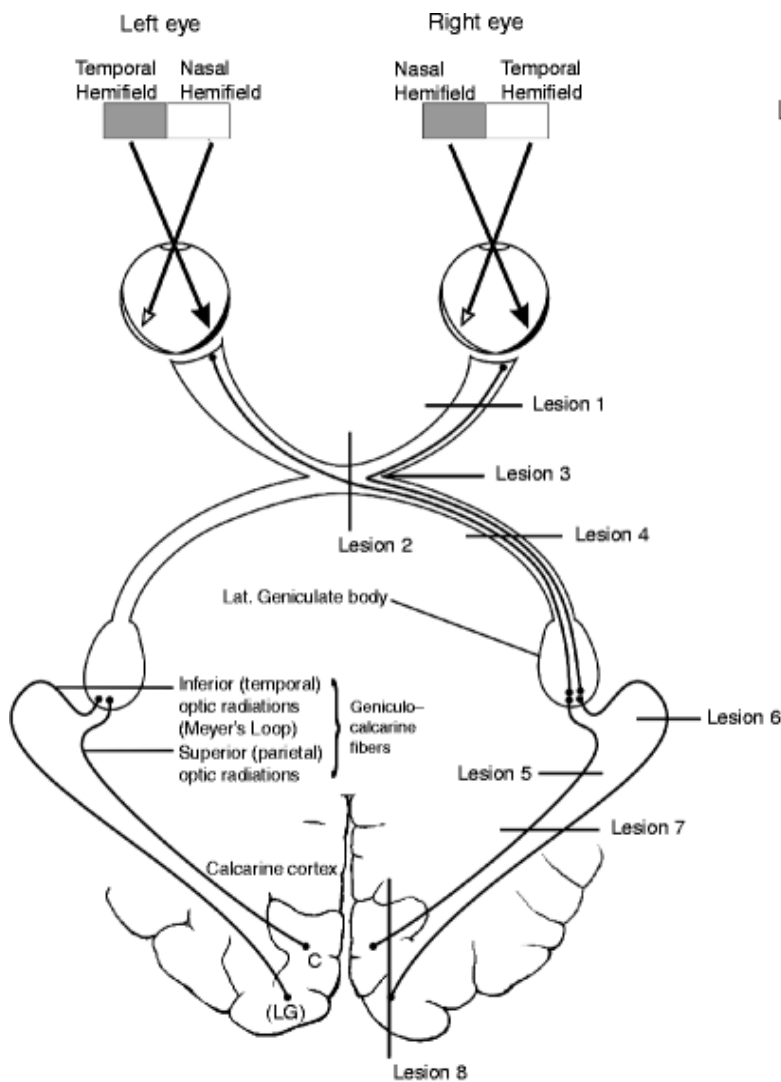
	<ul style="list-style-type: none"> • Perforation of Posterior (Pyloric) Or (Duodenal) Ulcer → Retroperitoneal Abscess.
Key 15	<ul style="list-style-type: none"> • CVE (Stroke) of the Temporal lobe → (Memory Impairment, Superior homonymous quadrantanopias). <p>PiTs:</p> <p>Parietal lobe affected → inferior homonymous quadrantanopias</p> <p>Temporal → superior homonymous quadrantanopias</p> <p>Temporal lobe lesion:</p> <p>Long-term memory loss + changes of <u>sexual</u> behaviour + (Visual defect) which is → superior homonymous quadrantanopias</p> <p>Frontal lobe lesion:</p> <p>changes of personality and <u>SOCIAL</u> behaviour, no visual field defect.</p>

















Example

An elderly with a Hx of Stroke presents with impaired long-term memory, altered sexual behaviour and visual defect. What is this visual defect?

His Affected lobe is → the **Temporal** lobe.

PiTs → **T**emporal lobe → **S**uperior Homonymous Quadrantanopias.



Visual fields			
Lesion	Lt. eye	Rt. eye	
1			monocular blindness
2			Bitemporal (heteronymous) hemianopia ¹
3			Ipsilateral Right nasal hemianopia
4			Left homonymous hemianopia
5			Left inferior quadrantanopia ²
6			Left superior quadrantanopia ³
7			Left homonymous hemianopia ⁴
8			Left homonymous hemianopia with macular sparing

1 May result from tumor pressing on Optic Chiasm. Visual field deficit usually not this cleanly divided or symmetrical.
2 May also result from lesions restricted to Cuneus
3 May also result from lesions restricted to Lingual Gyrus.
4 Total hemianopia less likely as compared to lesions of Optic Tract.

Key
16

The Rule of 17 for the Side of Deviation

10 + 7: Deviation to the **Opposite** side of the lesion

12 + 5: to the **Same** side of the lesion

10 vague, 7 facial, 12 hypoglossal, 5 trigeminal

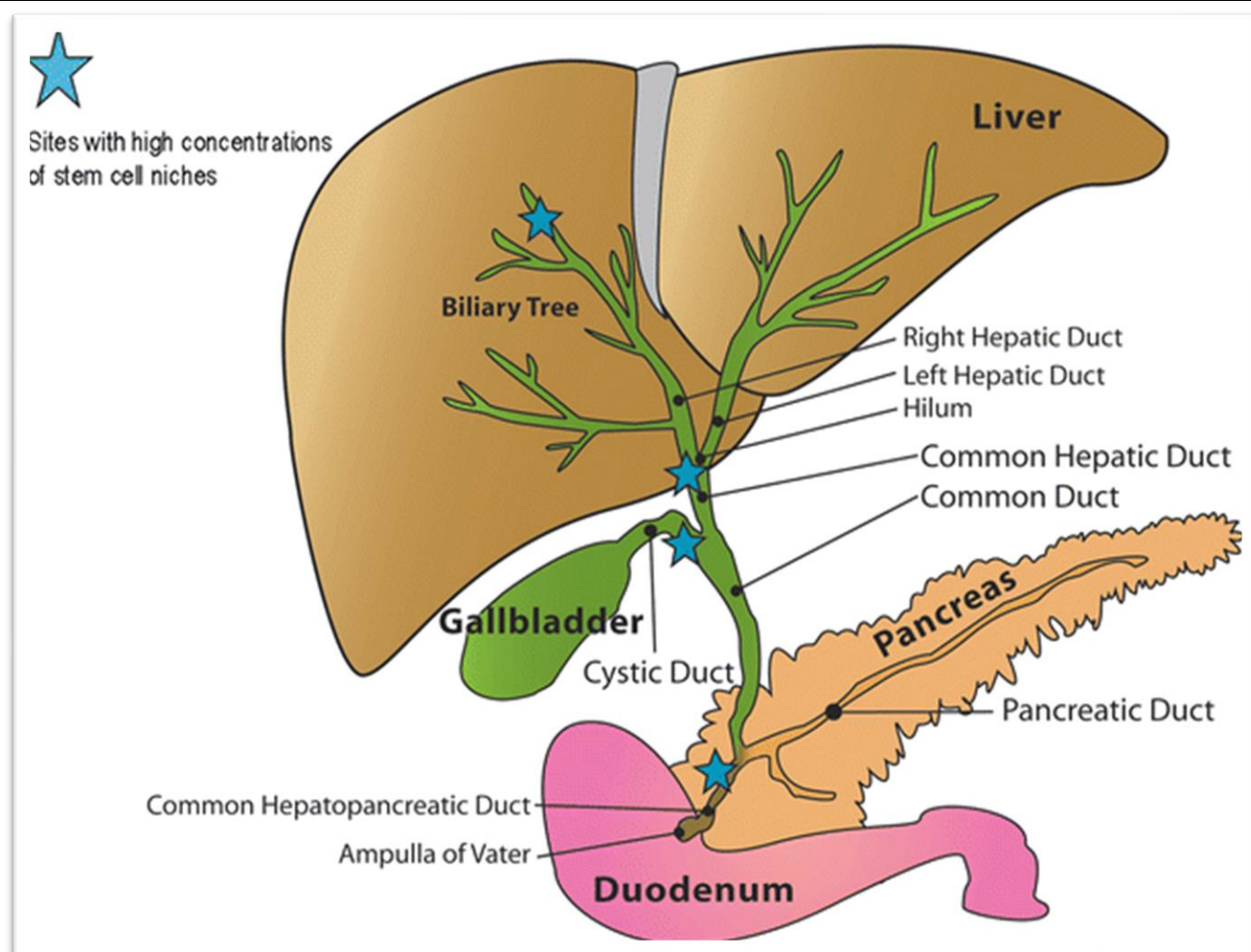
- 7th CN injury → **Facial** deviation (towards the **opposite** side)
- 10th CN injury → **Uvular** deviation (towards the **opposite** side)
- 5th CN injury → **Jaw** deviation (at the **same** side)
- 12th CN injury → **Tongue** deviation (at the **same** side as the injury)

Example

If tongue is deviated towards the right and there is an injury on the right side of the neck (the same side)

The likely injured structure → **hypoglossal (12th) CN**

	<p>10th (vagus): Uvular deviation (opposite side)</p> <p>7th (facial): Facial deviation (opposite side)</p> <p>12th (hypoglossal): Tongue deviation (same side)</p> <p>5th (trigeminal): Jaw deviation (same side)</p>
Key 17	<p>The Lymphatic drainage of the Testis → Para-aortic LNs.</p> <p>The Lymphatic drainage of the Scrotum → Superficial inguinal LNs.</p> <p><u>Remember:</u></p> <ul style="list-style-type: none"> • Gonads (Ovary, Testis) → Para-aortic LNs • Skin (Perineum, Scrotum, Vulva) → Superficial inguinal LNs
Key 18	<p>The Common bile duct (CBD) connects with the Pancreatic duct to form → the Ampulla of Vater (Hepatopancreatic ampulla) at the middle of the second part of duodenum.</p> <p>So, Ampulla of Vater = Hepatopancreatic ampulla.</p>



Example:

ERCP was done and found a calculus in the 2nd part of duodenum. What is the structure that contains this calculus?

→ **Hepatopancreatic Ampulla** (Or) **The Ampulla of Vater**

Key
19**Remember that,**

Common peroneal nerve gives **superficial peroneal** (which runs **laterally** and **everts** the foot), and **Deep peroneal** (which runs **anteriorly** and **dorsiflex** the foot and **give sensation to the area between 1st and 2nd toes**).

Example:

A man sat cross-legged for 40 minutes. He found himself unable to dorsiflex his left foot and there is loss of sensation over the area between the big toe and the second toe. What is the affected nerve?

→ **Deep Peroneal** (Deep Fibular) nerve which is a **branch of the common peroneal nerve**.

- **PED**: Peroneal nerve: Eversion, Dorsiflexion of the foot.
- **TIP**: Tibial nerve: Inversion, Planter flexion of the foot.

Key
20

The Common Bile duct (CBD) lies in a close proximity to the **head of pancreas**. Therefore, the initial presentation in 70% of head of pancreas cancer patients present with **Jaundice** due to the obstruction of CBD by the tumour.

Key
21

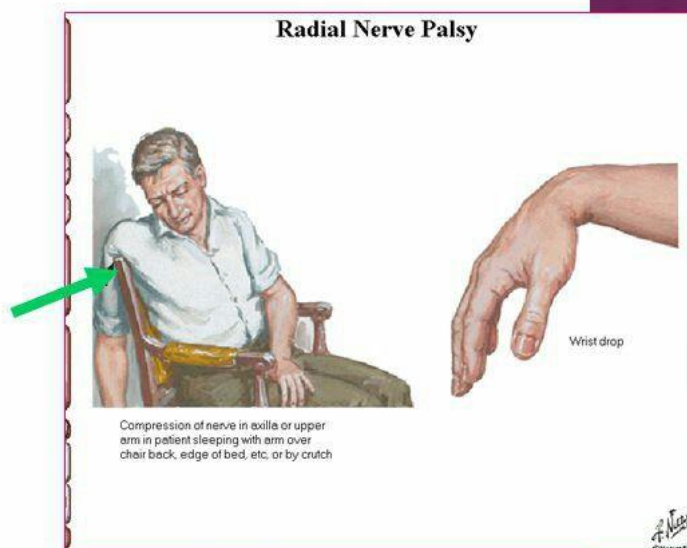
Saturday Night Palsy → Wrist drop → ((Radial Nerve)):

SATURDAY NIGHT PALSY

Radial Nerve Injury in
Axilla:

Mechanism:

1. Crutches pressing in axilla
2. Saturday night palsy!



Main Effect:

WRIST DROP

Radial nerve can be compressed against the operating table (medial aspect of the arm) during an operation. This is called **Saturday Night Palsy**.

Key
22

LN of **Posterior Oropharynx** → **Deep Cervical** LNS or (= **Jugular** LNs)

Key
23**Scenario:**

A man complains of pain on the medial side of his right forearm. There is **weakness of finger abduction and adduction** as well as thumb adduction. No abnormality with finger flexion. The right-hand muscles are slightly atrophied. What is the likely affected structure?

→ **T1 Nerve Root Injury**

- Fingers' Abduction and Adduction weakness → **T1 nerve root** injury.
- Thumb movement weakness, Wrist Ulnar deviation, Little finger Paraesthesia → **C8 nerve root** injury.
- Loss of Thumb Sensation, Loss of elbow flexion → **(C5,6) erb's palsy**

Key
24

Trigeminal Nerve branches: **Ophthalmic, Maxillary, Mandibular.**

Maxillary Nerve:

The 2nd branch of the trigeminal nerve, it supplies a number of structures:

- Sinuses: ethmoid, maxillary, sphenoid,
- Mucosa: palate, roof of pharynx, nasal mucosa,

- Others: lower eyelid, upper lip, upper teeth and gum, nares, Parts of the meninges.

N.B. The **palate** is a **mucous membrane**.

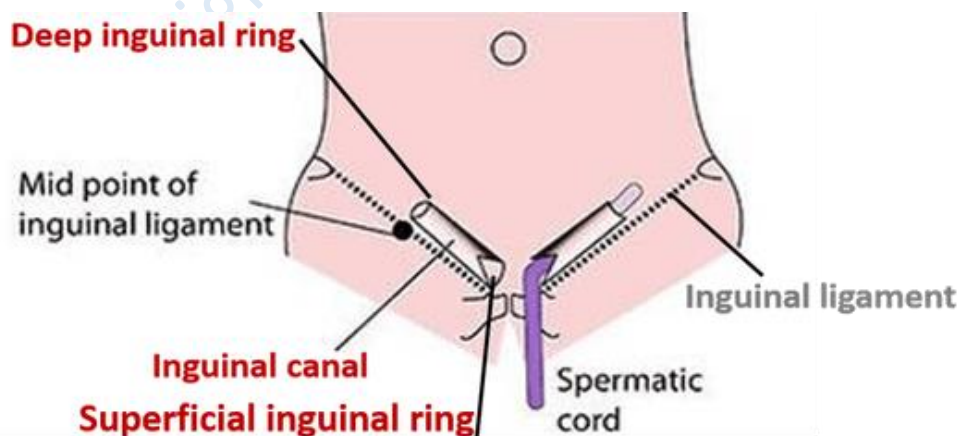
Example:

Herpes Zoster Virus along the dermatome of the maxillary nerve. What is the **MUCOSA** that would be affected?

→ **The Palate**.

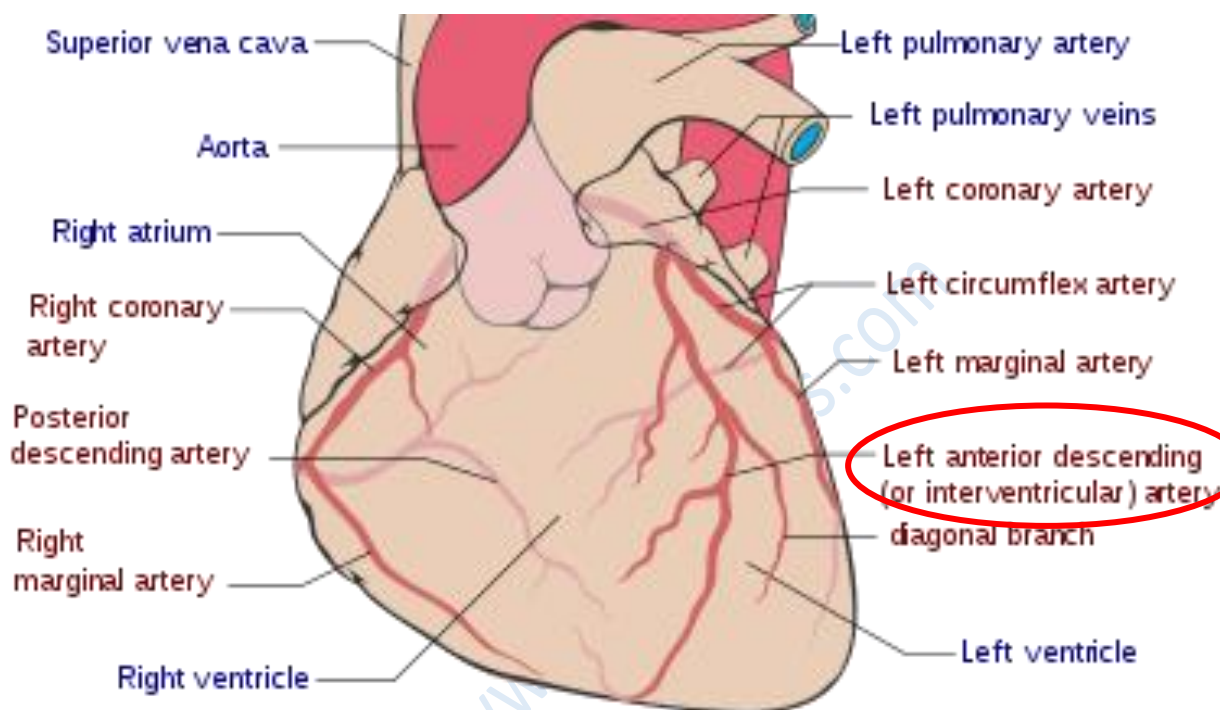
Key
25

The **Deep Inguinal Ring** is located about **1 inch (2.5 cm)** **ABOVE** the **midpoint of the inguinal ligament**.



Key
26

LAD (**Left Anterior Descending Artery**) is a continuation of the Left Coronary Artery, and it runs inside the **Anterior Interventricular groove**.



Key
27

- The skin at the **Medial Malleolus** drains into the **inguinal LNs**.
- The skin over the **Lateral Malleolus** → **popliteal LNs** → **inguinal LNs**.

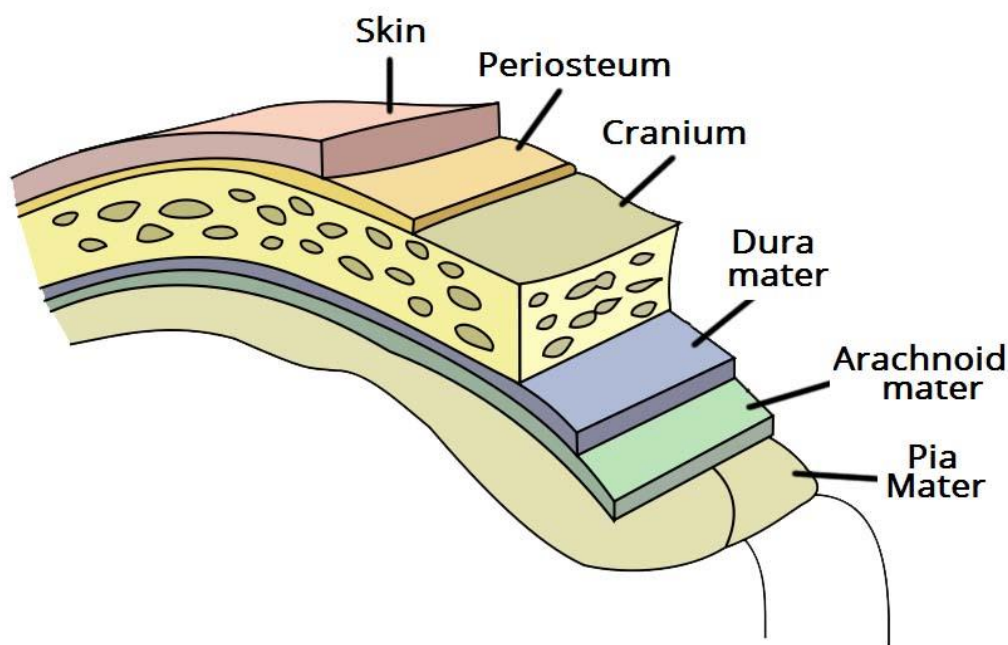
Remember that: During a surgery of melanoma of the feet, the **inguinal LNs** are dissected. So, medial malleolus skin is drained to the inguinal LNs.

Example:

A patient with a non-healing ulcer over the medial malleolus. What are the draining lymph nodes? → **Inguinal LNs**.

Key
28

■ **Glioma** is a tumour arising from the glial cells in the brain or spinal cord. So, the **dura matter** is to be opened during the surgery.



DAP (from outside inwards): **Dura** → **Arachnoid** → **Pia**

Key
29

- **Extensor Digitorum** → Extend **all fingers** at **MCP** and **IP** joints.
- **Extensor Digitorum Communis** → extends the phalanges first, then the wrist, then finally the elbow. It also tends to separates the fingers while extending them.

Example:

An elderly woman with Rheumatoid Arthritis has fallen down the stairs and she is now unable to extend her right-hand fingers at the metacarpophalangeal joints and the interphalangeal joints. What is the likely affected tendon?

→ **Extensor Digitorum.**

Key 30 A man presents complaining of diplopia while climbing down the stairs. What is the likely affected nerve?

Climbing the stairs = Downward gaze = Vertical Diplopia

Diplopia on Downward gaze → **Trochlear Nerve** (4th CN). Opposite.

Remember **O:T:A**

O (Oculomotor) 3 rd CN	T (Trochlear) 4 th CN	A (Abducens) 6 th CN
Same side	Opposite side	Same side
Dilated pupil, ptosis	Diplopia on Downgaze	Diplopia on Lateral gaze

Key
31

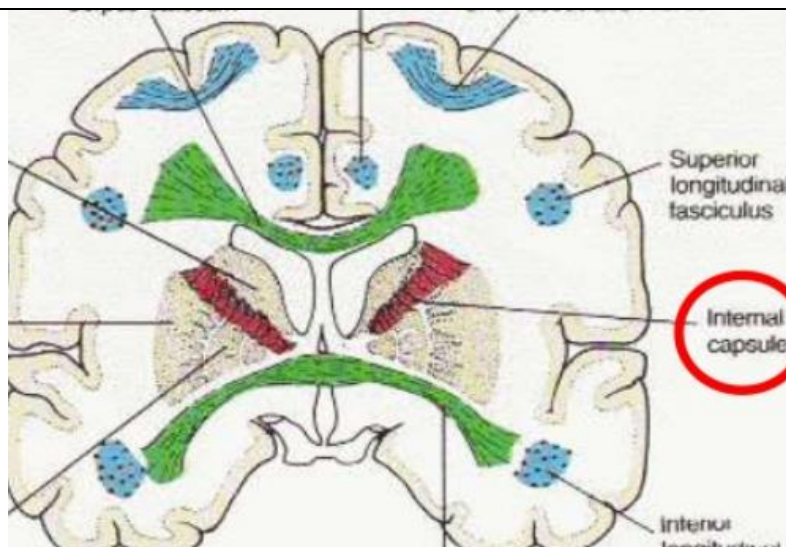
- **Ataxic Hemiparesis** (same side) + **Dysarthria**
→ **Lacunar infarct** (**Internal Capsule**). Internal capsule is a part of lacunas.
- “Contralateral” hemiplegia or Sensory Loss + Dysphasia + Homonymous Hemianopia
→ **Cerebral infarct.**
- Quadriplegia, Vertigo, Diplopia, Locked-in syndrome
→ **Brainstem infarct.**

Scenario:

An elderly woman had a stroke and developed paralysis of left upper and left lower limbs (Hemiparesis) and difficulty in speaking.

The likely affected anatomical site → **Internal Capsule** (Lacunas)

For those who do not know where is the internal capsule:



For your own knowledge

Locked-in Syndrome or Pseudocoma

- ✓ The patient is aware but cannot move or communicate verbally due to complete paralysis of nearly all voluntary muscles in the body except for vertical eye movements and blinking.
- ✓ Cognitive function is usually unaffected.
- ✓ Communication is possible through eye movements or blinking.
- ✓ **Locked-in syndrome** is caused by a damage to the **pons**, a part of the **brainstem** that contains nerve fibres that relay information to other areas of the brain.

Key
32

- **Central retinal artery** is a branch of the **Ophthalmic artery** which is a branch of the **Internal carotid artery**.

- Internal Carotid A. → Ophthalmic A. → Central Retinal A.

- **Amaurosis Fugax**: Painless, Temporary and Recurrent loss of vision that lasts from a few seconds to a few minutes due to embolism (transient occlusion) of the **Central retinal artery**.

- Usually resolves quickly.

- Risk Factors: Atherosclerosis ■ Hypertension.

- A patient may describe it as “A black Curtin Coming Down”

- The embolus in Amaurosis Fugax comes from atherosclerotic **Internal carotid artery** while in Transient Ischemic Attack (TIA), the emboli of the cerebral hemispheres come from the **heart**.

Amaurosis Fugax may present as “*painless unilateral loss of vision with a sensation that a black curtain has come down over the patient’s vision*”.

However, Amaurosis Fugax is “**transient**”; usually resolves **in 5-30 minutes**. It is due to temporary retinal ischemia “**transient occlusion of the central retinal artery**”.

Scenario:

An elderly man presents with a 4-hour sudden painless loss of vision of the right eye. He has Hx of recurrent and transient episodes of sudden loss of vision of the same eye. The patient is a heavy smoker and has hypertension.

- The likely affected artery → **Central Retinal Artery**.

Key
33

A white lesion on the middle third of the tongue drains to which LNs?

→ **Submandibular LNs**

- Tip of tongue: **Submental LNs**.
- Anterior 2/3 of tongue: **Submandibular LNs**.
- Posterior 1/3 of tongue: **Jugulo-Omohyoid (Deep Cervical LNs)**.

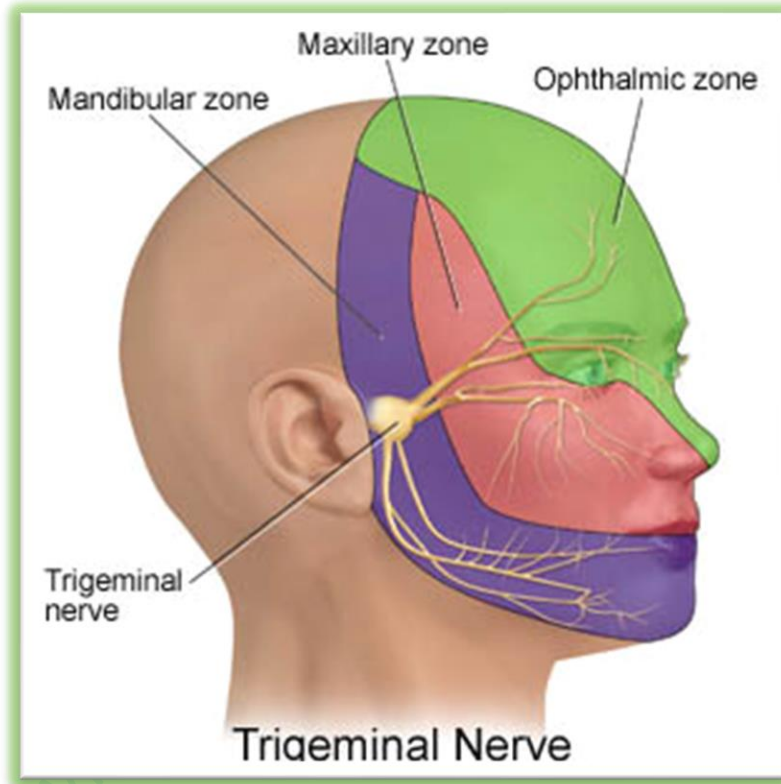
Key
34

• **Trigeminal Nerve (the 5th CN) has 3 divisions:**

✓ 1st: **Ophthalmic**

✓ 2nd: **Maxillary**

✓ 3rd: **Mandibular**



- **Trigeminal nerve** (5th CN) → gives the **Mandibular nerve** (the third division).
- → The mandibular nerve gives the **Inferior alveolar nerve** (which innervates the lower teeth).
- → The inferior alveolar nerve gives the **Mental nerve** that supplies **Chin, Lower lip** (Skin and Mucosa).

Trigeminal → Mandibular → Inferior Alveolar → Mental

- Inferior Alveolar Nerve is often injured during dental procedures and mandibular trauma.

Therefore, a loss of sensation of the lower lip and chin after a mandibular trauma/fracture is usually due to the injury of

→ **Inferior Alveolar nerve.**

Key
35

- Unilateral Injury to the **Recurrent laryngeal** nerve
→ **Hoarseness** of voice.
- Bilateral Injury to the **Recurrent laryngeal** nerve
→ **Aphonia ± Airway obstruction.**
- Injury to the **External branch of (superior) laryngeal** nerve
→ **Loss of high-pitched sound = (Dysphonia) = (Mono toned voice).**

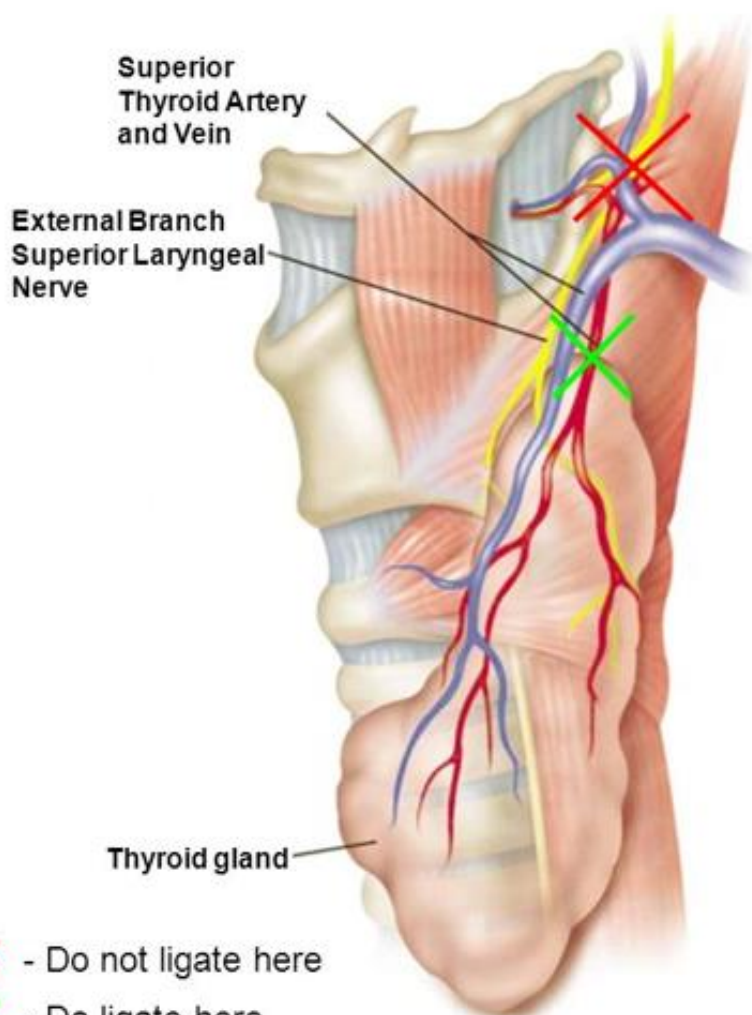
N.B. About 18% of **Lung cancer** patients experience **hoarseness** of voice due to compression of the tumour on the **recurrent laryngeal nerve**.

Recurrent laryngeal nerve is a branch of **Vagus** nerve (10th CN)

Important Points

- Superior thyroid artery is closely related to external laryngeal nerve at its origin
- Nerve moves away from the artery as artery approaches the upper pole of the gland.
- In order to avoid injury of external laryngeal nerve the superior thyroid artery need to be ligated during surgery just near the superior pole of thyroid gland
- A superior laryngeal nerve injury will lead to changes in the pitch of the voice and causes an inability to make explosive sounds due to paralysis of the cricothyroid muscle.
- A bilateral injury presents as a tiring and hoarse voice.

✗ - Do not ligate here
✗ - Do ligate here



A patient with lung cancer on chemotherapy presents with hoarseness

→ **Recurrent Laryngeal Nerve Palsy.**

Others:

- Hypoglossal Nerve (12th) → Tongue muscles

- Phrenic nerve → Diaphragm

Key
36

Important Anatomical Levels

- Umbilicus level → L3/L4

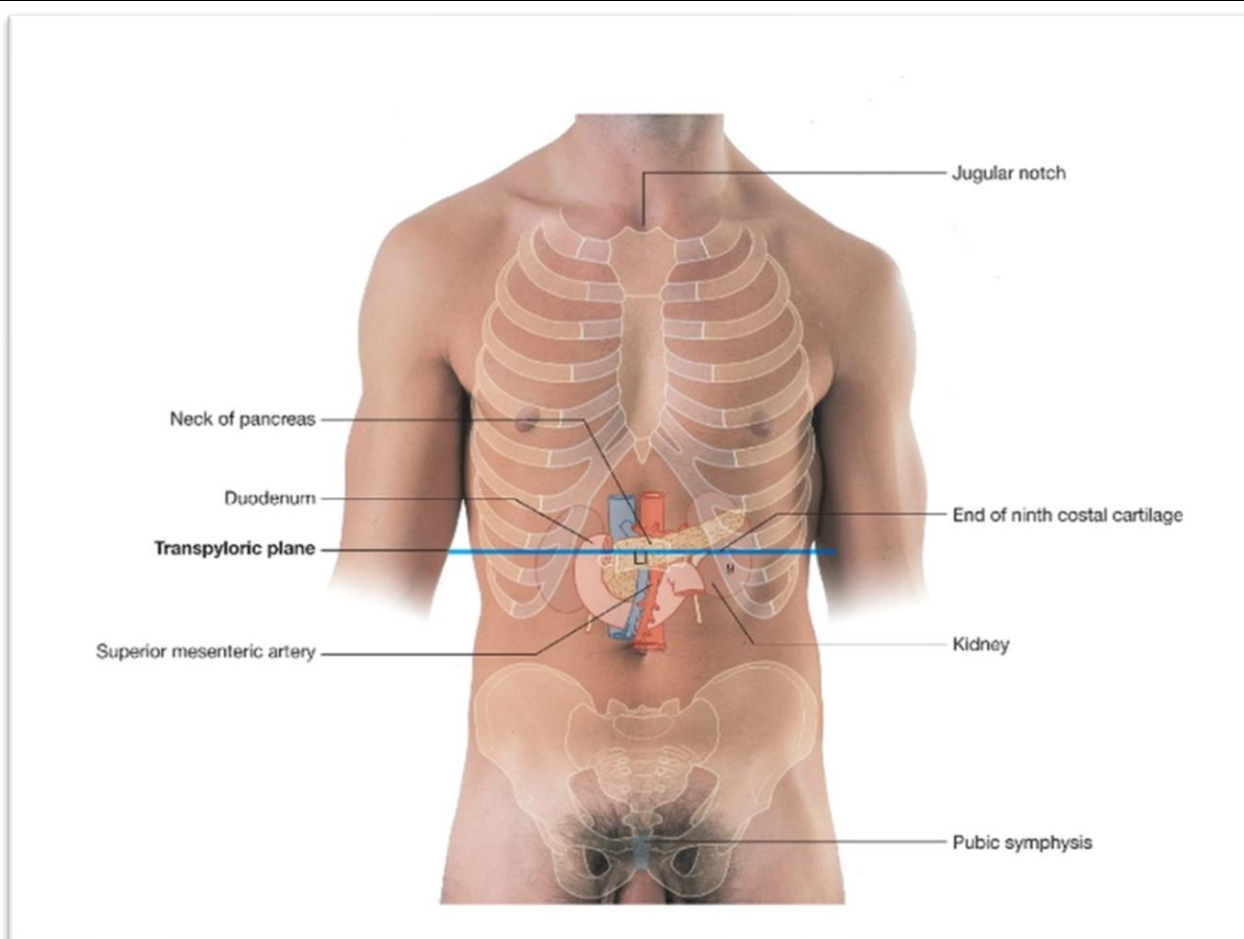
- The level of iliac crest → L4

We know that the umbilicus level is between L3 and L4. Therefore, the iliac crest (below the umbilicus level) would be L4.

- Umbilical Dermatome: T10
- Transpyloric plane → L1 → 9th Costal Cartilage, GB fundus, Stomach pylorus, Kidney hilum, SMA (Superior mesenteric artery), Celiac trunk.

All these structures are at the L1 level.

N.B. **Transpyloric plane** (or **Addison's plane**) is a transverse line located midway between **sternal notch** and **symphysis pubis**.



- **T8**: IVC (Inferior Vena Cava)
- **T10**: Oesophagus (O → O | Oesophagus → T1O)
- **T12**: Aorta

Mnemonic (IOA) → I O pened A door → IVC, Oesophagus, Aorta (T8, 10, 12).

Key 37 When inserting a chest drain in the 5th ICS anterior to mid-axillary line, not only the vessels (**VAN**) intercostal Vein, Artery and Nerve can be pierced, but also **intercostal MUSCLE** is liable to be pierced.

Key
38

- **Extensor Pollicis Longus**

→ (Extends the **Thumb** at the interphalangeal joints “**IP**”).

- **Extensor Pollicis Brevis**

→ (Extends **Thumb** at Metacarpophalangeal **MCP** joints)

Example:

A man with a Hx of fractured radius presents with inability to **extend** his **thumb** at the **interphalangeal joint**.

The likely Affected structure → **Extensor Pollicis Longus**.

Key
39

Example:

A man with a Hx of Rheumatoid arthritis hits the door by his hand and presents with inability to **extend** his **thumb** at the **metacarpophalangeal joint**. However, he is able to extend his thumb at the interphalangeal joint.

The likely Affected structure → **Extensor Pollicis Brevis**.

- **Extensor Digitorum** → Extend **all fingers** at **MCP** and **IP** joints.
- **Extensor Digitorum Communis** → extends the phalanges first, then the wrist, then finally the elbow. It also tends to separates the fingers while extending them.

Example:

An elderly woman with Rheumatoid Arthritis has fallen down the stairs and she is now unable to extend her right-hand fingers at the metacarpophalangeal joints and the interphalangeal joints. What is the likely affected tendon?

→ **Extensor Digitorum.**

Key
40

An important landmark above the 5th intercostal space and just anterior to the mid-axillary line

→ the site of **Chest Drain Insertion.**

Key 41 A patient with right eye **ptosis**, outward gaze and diplopia.

The affected structure → **Right Oculomotor nerve** (3rd CN)

Remember: Pt**O**sis → **O**culomotor. (**Same Side**)

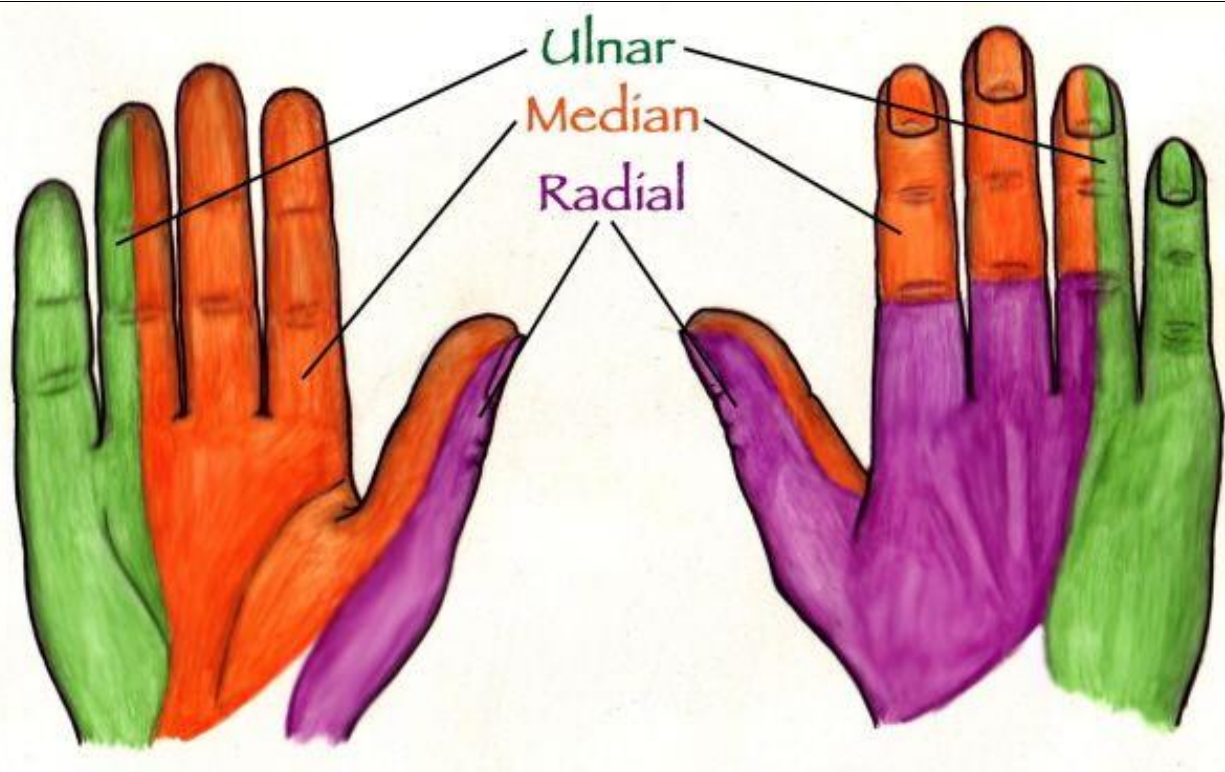
O:T:A

O (Oculomotor) 3 rd CN	T (Trochlear) 4 th CN	A (Abducens) 6 th CN
Same side	Opposite side	Same side
Dilated pupil, ptosis	Diplopia on Downgaze The affected muscle → <u>Superior obliques (SO4)</u> . (vertical diplopia)	Diplopia on Lateral gaze

Key 42 **Structures at the level of L1 → Transpyloric plane**

- **9th Costal Cartilage,**
- **GB fundus,**
- **Stomach pylorus,**
- **Kidney hilum,**

	<ul style="list-style-type: none"> • SMA (Superior mesenteric artery), • Celiac trunk.
Key 43	<p>Paraesthesia (Loss of sensation) of the little finger + ring finger</p> <p>→ Ulnar nerve</p> <p><u>Remember that:</u></p> <ul style="list-style-type: none"> • Paraesthesia of the lateral three fingers (thumb, index, MIDDLE) fingers → Median Nerve. (nearly 3 and a half fingers) • Paraesthesia of little finger + ring finger (both dorsal and palmar) → Ulnar nerve • Paraesthesia of the dorsal aspect of the THUMB ± a small dorsal area between 1st (Thumb) and 2nd (Index) fingers → Radial Nerve.



Key
44

A blow or a trauma to the lateral aspect of the area below the knee

→ **Peroneal Strike**

The resulting lesion → **foot drop** (inability to evert or dorsiflex foot)

The affected nerve → **Common peroneal nerve**.

Key
45

If the strike was above the knee and the resulted abnormality was foot drop, the affected nerve is also

→ **Common peroneal nerve**.

Key
46

There is **no C8 vertebra**, it is just a **nerve root** that emerges below C7.

Also:

Median nerve: C5-**T1**

Ulnar nerve: C8-**T1**

These are roots, not vertebrae.

Both **Median** and **Ulnar** nerves are responsible for the **weakness of the hands**

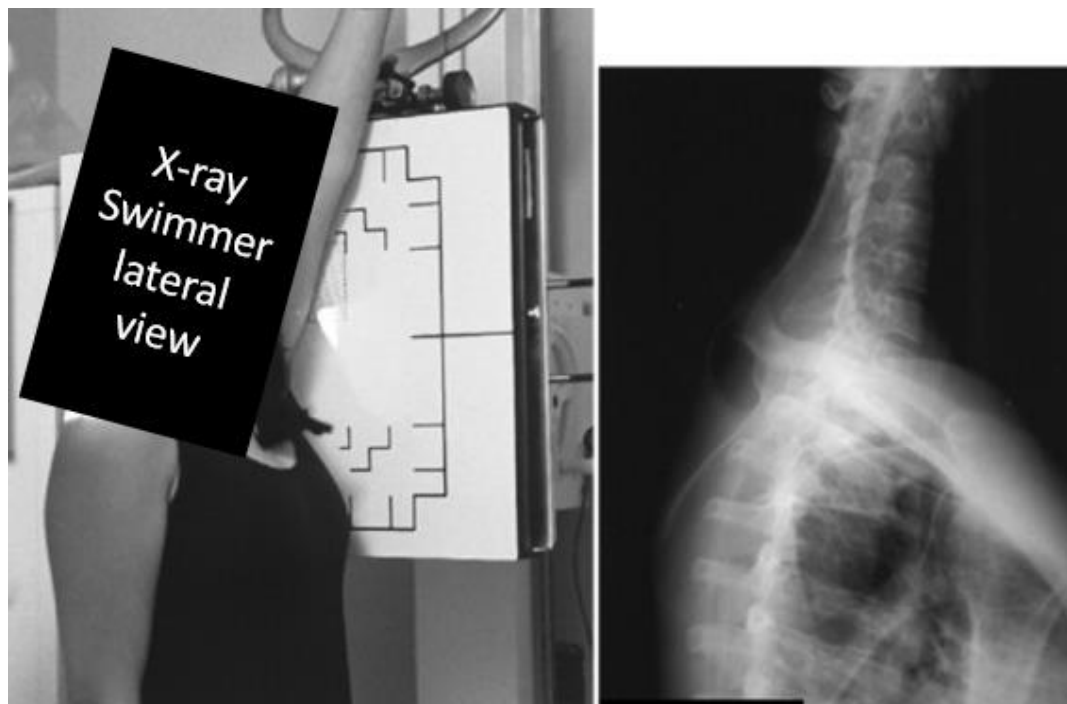
Important: On a lateral neck X-ray, the lowest level needed to be seen after a neck injury is → **C7-T1**

These are vertebrae (to be seen on X-ray). C8 is not vertebra; it is a nerve root.

In a suspected Cervical fracture, we need to get X-ray of all cervical vertebrae from **C1 to C7**

Sometimes, [C7-T1 junction] does not appear on **AP, Lateral, Open-mouth odontoid (the peg view)** X-rays. Hence, requesting what is called (**Swimmer Lateral view**) is required.

Again, if this does not show C7-T1 junction → request **CT Scan**.



Key 47 A sudden fall on a knee → pain and swelling below the knee cap → The affected structure is either **infrapatellar** or **prepatellar bursa**.

Prepatellar bursitis is the most common type among the knee bursae inflammations. The prepatellar bursa is a thin bursa in front of the knee (between the knee and the patella). It is commonly seen in people who kneel a lot such as housemaids and plumbers.

Features:

✓ redness, pain, swelling, inability to flex knee

✓ **Rest** usually relieves the symptoms.



Remember that:

- Housemaid Knee: Prepatellar bursitis.
- Clergyman or jumper's Knee: Infrapatellar bursitis.

Key
48

Again:

Scrotum drains to → **Inguinal** LNs. (particularly: Superficial inguinal LNs)
While testis drains to → para-aortic LNs

Key
49

A man complains of double vision when looking to the **right**.

The likely affected nerve is → **Right Abducens**

Diplopia on lateral gaze → Abducens nerve (Same Side)

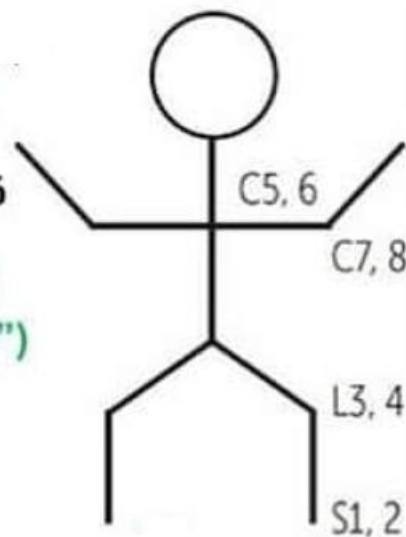
O:T:A

O (Oculomotor) 3rd CN	T (Trochlear) 4th CN	A (Abducens) 6th CN
Same side	Opposite side	Same side
Dilated pupil, ptOsis	Diplopia on Downgaze	Diplopia on Lateral gaze

Key
50

Nerve roots of the important deep tendon reflexes

- Achilles reflex = S1, S2 ("buckle my shoe")
- Patellar reflex = L3, L4 ("kick the door")
- Biceps and brachio-radialis reflexes = C5, C6 ("pick up sticks")
- Triceps reflex = C7, C8 ("lay them straight")
- Cremasteric reflex = L1, L2 ("testicles move")
- Anal wink reflex = S3, S4 ("winks galore")



So:

- ◆ Biceps C5 and C6
- ◆ Brachioradialis C6 and C7
- ◆ Triceps C7 and C8
- ◆ Ankle (Achilles) S1 and S2
- ◆ Anal (contraction of external sphincter) S2-S4
- ◆ Knee L3 and L4

Key
51

The land mark that is midway between symphysis pubis and suprasternal notch → **Transpyloric plane** (L1 Level)

Notes:

- Suprasternal notch = jugular notch = fossa jugularis sternalis.
- **Facial Nerve (7th) Lesion**
 - facial weakness + Loss of taste of the Anterior 2/3 of tongue + ↓ Salivation.
- **Vagus Nerve (10th) lesion**
 - Weak cough, Vocal Cord Paralysis with Dysphonia, uvular deviation.
 - Also, parasympathetic loss of Respiratory, GIT, CVS.
- **Trigeminal Nerve (5th) lesion:**
 - Weakness of the muscles of Mastication.
 - Deviation of Jaw towards the same side of the weak pterygoid muscle
 - Loss of facial sensation

- **Glossopharyngeal Nerve (9th) lesion:**

- Loss of gag reflex
- Loss of taste from the Posterior 1/3 of the tongue
- Loss of general sensation from posterior pharynx, tonsils, and soft palate.

So, Loss of Taste Sensation:

✓ Ant. 2/3: Facial Nerve (7th)

✓ Post. 1/3: Glossopharyngeal (9th)

- **Hypoglossal Nerve (12th):**

→ Innervates the muscles of the tongue. An injury to it would deviate the tongue to the same side as the injury side.

Also Remember:

10 + 7: Deviation to the Opposite side of the lesion

12 + 5: to the Same side of the lesion

10 vague, 7 facial, 12 hypoglossal, 5 trigeminal

- 7th CN injury → **Facial** deviation (towards the **opposite** side)
- 10th CN injury → **Uvular** deviation (towards the **opposite** side)

- 5th CN injury → **Jaw** deviation (at the **same** side)
- 12th CN injury → **Tongue** deviation (at the **same** side as the injury)

Key
52

Dupuytren's contracture

- A condition in which there is fixed forward curvature of one or more fingers, caused by the development of a **fibrous connection** between the finger tendons and the skin of the palm.
- Dupuytren's contracture has a prevalence of about 5%.
- It is more common in older male patients.
- 60-70% have a **positive family history**.
- **Specific causes include:**

Manual labour ■ Phenytoin treatment

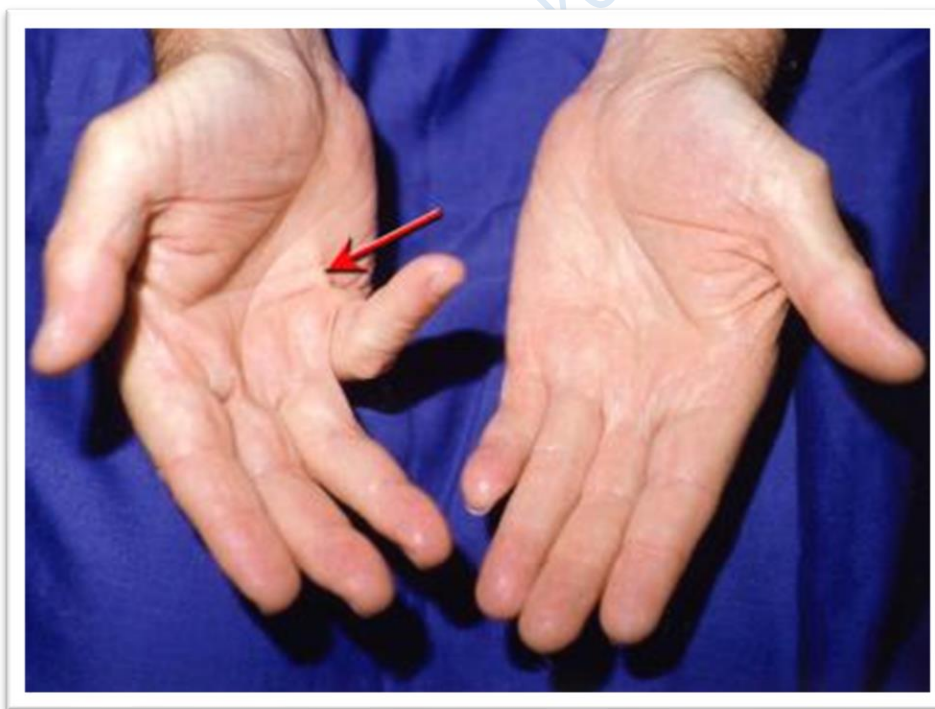
Alcoholic liver disease ■ Trauma to the hand

DM ■ Smoking

- Mechanism

→ Formation of thickened fibrous tissue within the palmar fascia. v imp

- Rx → Fasciotomy



Scenario:

A 38-year old man is unable to extend and straighten his 4th and 5th fingers (ring and little fingers). A firm nodule was found on the distal palmar crease in the same line with the ring finger. His father has a Hx of a similar condition.

■ The likely diagnosis → **Dupuytren's contracture**.

■ The likely mechanism

→ **Formation of thickened fibrous tissue within the palmar fascia.**

Key
53

Sensory Loss Responsible Nerve Roots in LL:

3 in the thigh ■ **2 in the shin** ■ **1 in the foot**

- Groin and pelvic Girdle → **L1**
- Anterior thigh → **L2**
- Inner (Medial) thigh and distal anterior thigh → **L3**
- Inner (medial) shin → **L4**
- Outer (Lateral) shin and **Dorsum of the foot** → **L5**
- Lateral Foot → **S1**

Scenario (1):

A man develops severe low back pain shooting down his right leg after lifting heavy objects. His Ankle and Knee reflexes are intact. He has reduced sensory stimulus over the dorsum of the right foot.

The likely nerve root affected → **L5**

Knee reflex is intact → (Not L3 or L4)

Ankle Reflex is intact → (Not S1 or S2)

Reduced sensation over the foot **dorsum** (and lateral shin) → L5

Scenario 2:

A patient with DM present for routine check-up. His reflexes and motor functions are normal. However, there is a deficit in fine touch sensation on the medial aspect of his lower right leg.

The likely dermatome to be affected → **L4**

(inner shin = Medial side of a leg = L4)

Key
54

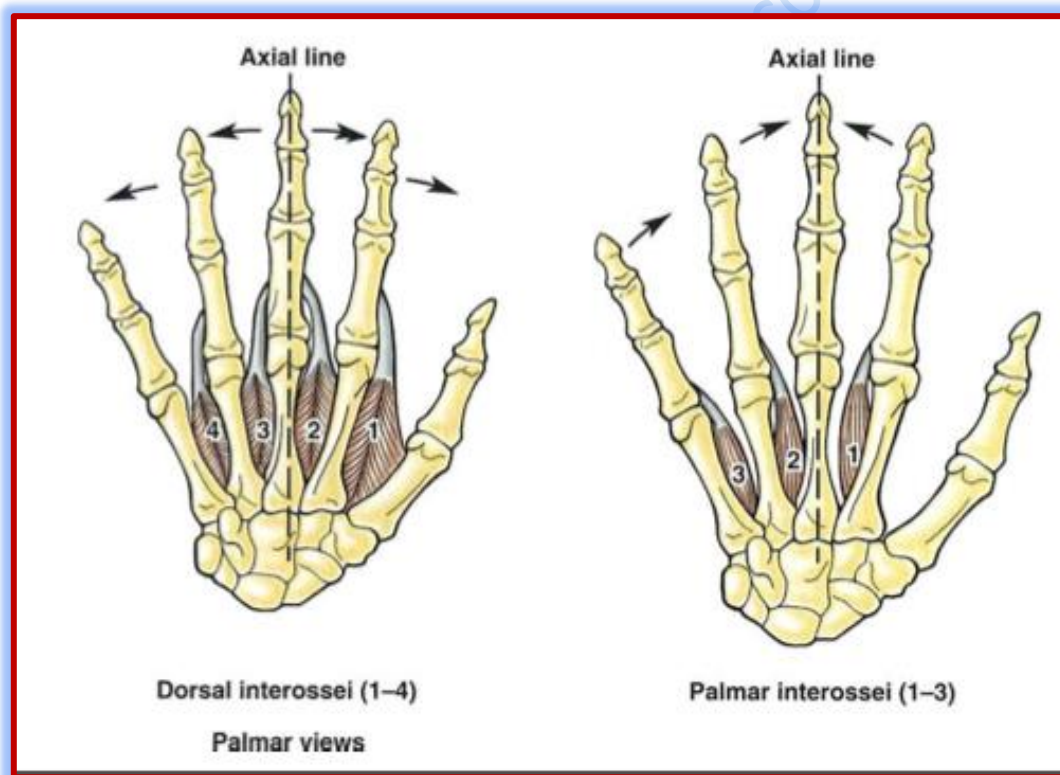
A 40 YO man had a left elbow injury. Following that, he developed a loss of sensation over the ulnar side of his left hand. His hand looks "Claw".

Which movement against resistance would help confirm an injury to the affected nerve?

◆ The injured nerve is → **Ulnar nerve** (Claw hand + Paraesthesia of little finger + ring finger “ulnar border”).

◆ As the ulnar nerve supplies **dorsal** and **palmar interossei** that are involved in **fingers adduction and abduction**, the answer would be:

→ **Abduction of the fingers**



Key 55 The level of iliac Crest → **L4**

Key
56

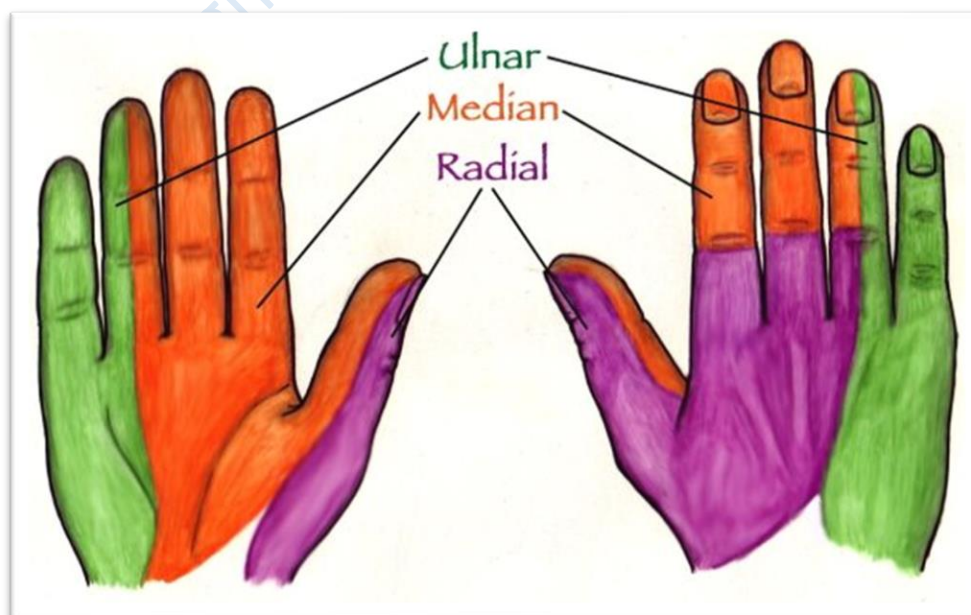
■ Paraesthesia (Loss of sensation) of the little finger + ring finger

→ **Ulnar nerve****Remember that:**

■ Paraesthesia of the lateral three fingers (thumb, index, MIDDLE) fingers

→ **Median Nerve**.

■ Paraesthesia of little finger + ring finger (both dorsal and palmar)

→ **Ulnar nerve**.■ Paraesthesia of the dorsal aspect of the THUMB ± a small dorsal area between 1st (Thumb) and 2nd (Index) fingers→ **Radial Nerve**.

Key 57	<p>■ During a laparoscopic cholecystectomy, the <u>midline</u> structure that is pierced is → Linea Alba.</p> <p>■ While performing laparoscopy, the anatomical structure(s) to be pierced while inserting a port at the midway point between umbilicus and anterior superior iliac spine is</p> <p>→ Internal oblique muscle and external oblique aponeurosis.</p> <p>■ While performing a laparoscopic cholecystectomy, the first anatomical structure(s) to be pierced while inserting a port at the midway point between Anterior midline and mid-axillary line is</p> <p>→ External oblique aponeurosis and Internal oblique muscle.</p> <p>■ When inserting a chest drain in the 5th ICS anterior to mid-axillary line, not only the vessels (VAN) intercostal Vein, Artery and Nerve can be pierced, but also intercostal MUSCLE is liable to be pierced.</p>
Key 58	<p>After a right wrist injury, a man lost sensation over the palmar side of the index, thumb, middle fingers and half the ring finger. There is also atrophy of the thenar eminence. He cannot touch his right little finger with his right thumb.</p>

	The likely injured nerve is → Median nerve .
Key 59	<p>A man sustained a trauma below the knee and presented with loss of foot dorsiflexion. The affected nerve is:</p> <p>→ Common peroneal nerve.</p>
Key 60	<p>During chest drain Insertion, the structure that might be damaged</p> <p>→ Intercoastal Artery</p> <p>Also, intercostal VAN (Vein, Artery, Nerve) and intercostal muscles.</p>
Key 61	The level of iliac Crest → L4
Key 62	<p>■ A swelling behind the knee (in the popliteal fossa), usually asymptomatic, round, smooth, non-tender → Baker cyst (popliteal cyst)</p>
Key 63	<p>■ Numbness and Tingling of the thumb, index and middle fingers</p> <p>→ Think of Carpal Tunnel Syndrome (Median Nerve)</p>

✓ **Pregnancy** is an important **risk factor** for Carpal Tunnel Syndrome (due to fluid retention).

✓ **Tinel Test is not always positive** in Carpal Tunnel Syndrome “very low sensitivity”.

☐ The **Transverse Carpal Ligament** compresses the **MEDIAN nerve**.

☐ Thus, the treatment would be → **Cut the Transverse Carpal Ligament** to release the pressure on the median nerve.

♠ **Note:** **Transverse Carpal Ligament** is also called = **Flexor Retinaculum** = **Anterior Annular Ligament**.

Key 64 A man is unable to abduct and adduct his fingers, X-ray neck showed cervical vertebrae showing degenerative changes. The likely nerve root of brachial plexus affected?

- a. C5
- b. C6
- c. C7
- d. C8
- e. **T1**

C8 radiculopathy

Affects **thumb abduction and extension, ulnar deviation of the wrist**, and causes paraesthesia of a thin area on the forearm which runs down to include the little finger.

T1 Radiculopathy

Affects **Fingers Abduction and Adduction**, Pain and Paraesthesia along the affected nerve.

Key
65

Patient with cut to the wrist and inability to flex the distal phalanx of little finger. Which structure is damaged?

A) **flexor digitorum profundus**

B) flexor digitorum superficialis

C) ulnar nerve

- Unable to flex the “**Proximal**” interphalangeal joints AND Metacarpophalangeal (MCP) joint →

Flexor Digitorum Superficialis.

- Unable to flex the “**Distal**” interphalangeal joints →

Flexor Digitorum profundus.

Key
66

A man who works as a builder was working with a screwdriver and felt that something gives way in his upper arm. There is a bulging present in the upper part of his arm.

A. **Tendon rupture**

B. Muscle haematoma

- **Proximal Biceps Tendon Rupture**: Muscle bunches up in the distal arm, **Popeye** appearance.
- **Distal Biceps Tendon Rupture**: Single traumatic event (e.g. flexion against resistance), sudden sharp tearing sensation, painful swollen elbow, weakness of flexion and supination.

The patient feels that something in the cubital fossa has ruptured

Key 67 A man with crutches having weakness on the left arm on dorsiflexion of wrist, and wrist drop, structure affected?

- a. C5
- b. C6
- c. **Radial nerve**
- D. Interosseous nerve
- E. Median nerve

Radial Nerve (C5-T1)

- Motor supply to the Extensors of the (thumb, fingers, wrist and forearm).
If damaged → **Wrist Drop**
- Radial nerve can be compressed against the operating table (medial aspect of the arm) during an operation →
(Saturday Night Palsy).
- Also, **Crutch palsy** (a compression against the **spiral groove** on the medial aspect of humerus).

- Injury to the **Radial nerve** can also lead to **sensory loss** of the dorsal aspect of the **THUMB** ± a small area over the dorsal aspect between **1st** and **2nd** fingers.



Key 68 A young man presents with sudden pain in the chest while lifting weights. He is unable to lift the arm above the head. He also has difficulty in abducting his left arm beyond 90. When the arm is stretched out against resistance, the scapula is noticed to be prominent. Injury to which of the following nerves is affected?

- A. Dorsal scapula nerve
- B. **Long thoracic nerve**
- C. Posterior interosseus nerve
- D. Axillary nerve
- E. Thoracodorsal nerve

Long thoracic nerve (C5-C7)

Serratus anterior

Long thoracic nerve (C5-C7)Serratus
anterior

Often during sport e.g. following a blow to the ribs. Also, possible complication of mastectomy

Damage results in a **winged scapula**

Key
69

Femoral Nerve Injury:

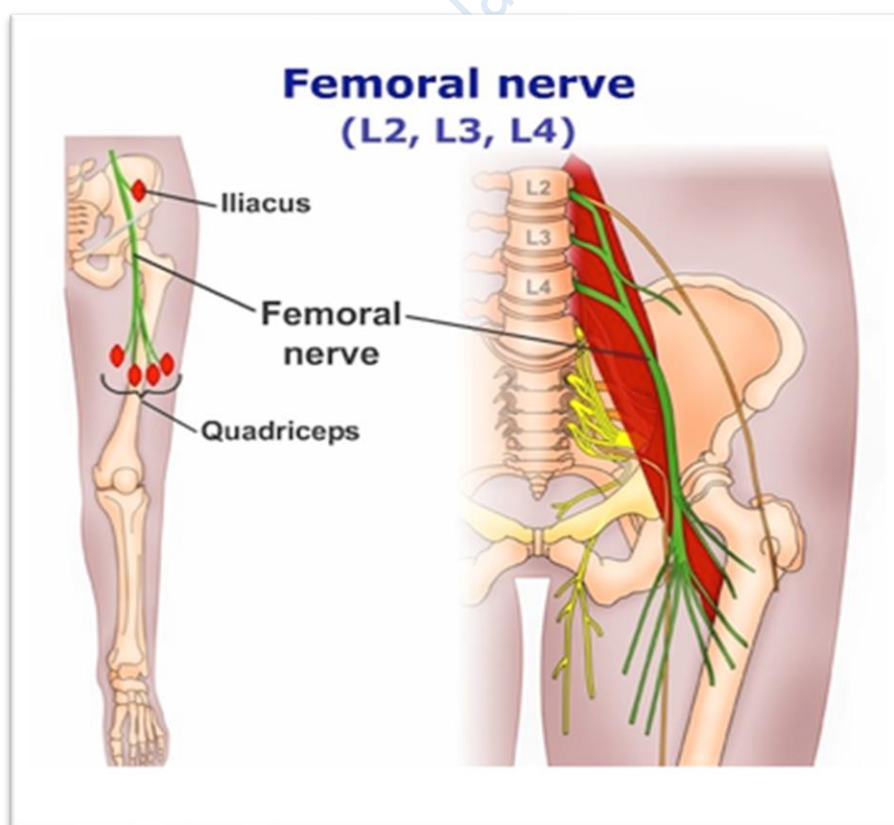
e.g. a stab injury to the inguinal area.

✓ Weakness on **hip flexion**.

✓ Weakness on **knee extension**.

✓ Loss of sensation; paraesthesia over the **anterior side of thigh** and the **medial side of the lower leg**.

✓ Wasting of **quadriceps muscles**.



Example:

A 23-year-old man had a recent sports-related injury to his left groin region. He experiences difficulty extending his left knee. He has significant loss of sensation in the anterior thigh and the medial side of the lower leg. What is the most likely injured nerve?

→ **Femoral Nerve.**

Key
70

Lower limb anatomy

Nerve	Motor	Sensory	Typical mechanism of injury & notes
Femoral nerve	Knee extension, thigh flexion	Anterior and medial aspect of the thigh and lower leg	Hip and pelvic fractures Stab/gunshot wounds
Obturator nerve	Thigh adduction	Middle part of Medial thigh	Anterior hip dislocation
Lateral cutaneous nerve of the thigh	None	Lateral and posterior surfaces of the thigh	Compression of the nerve near the ASIS → meralgia paraesthetica, a condition characterised by pain, tingling and numbness in the distribution of the lateral cutaneous nerve

	Tibial nerve	Foot plantarflexion and inversion	Sole of foot	Not commonly injured as deep and well protected. Popliteal lacerations, posterior knee dislocation
	Common peroneal nerve	Foot dorsiflexion and eversion Extensor hallucis longus	Dorsum of the foot and the lower lateral part of the leg	Injury often occurs at the neck of the fibula Tightly applied lower limb plaster cast Injury causes foot drop
	Superior gluteal nerve	Hip abduction	None	Misplaced intramuscular injection Hip surgery Pelvic fracture Posterior hip dislocation Injury results in a positive Trendelenburg sign
	Inferior gluteal nerve	Hip extension and lateral rotation	None	Generally injured in association with the sciatic nerve Injury results in difficulty rising from seated position. Can't jump, can't climb stairs

Key
68

A young 'an presents' with sudden pain in the chest while lifting weights. He is unable to lift the arm above the head. He also has difficulty in abducting his left arm beyond 90. When the arm is stretched out against resistance, the scapula is noticed to be prominent. Injury to which of the following nerves is affected?

- A. Dorsal scapula nerve
- B. **Long thoracic nerve**
- C. Posterior interosseus nerve
- D. Axillary nerve
- E. Thoracodorsal nerve

Long thoracic nerve (C5-C7)

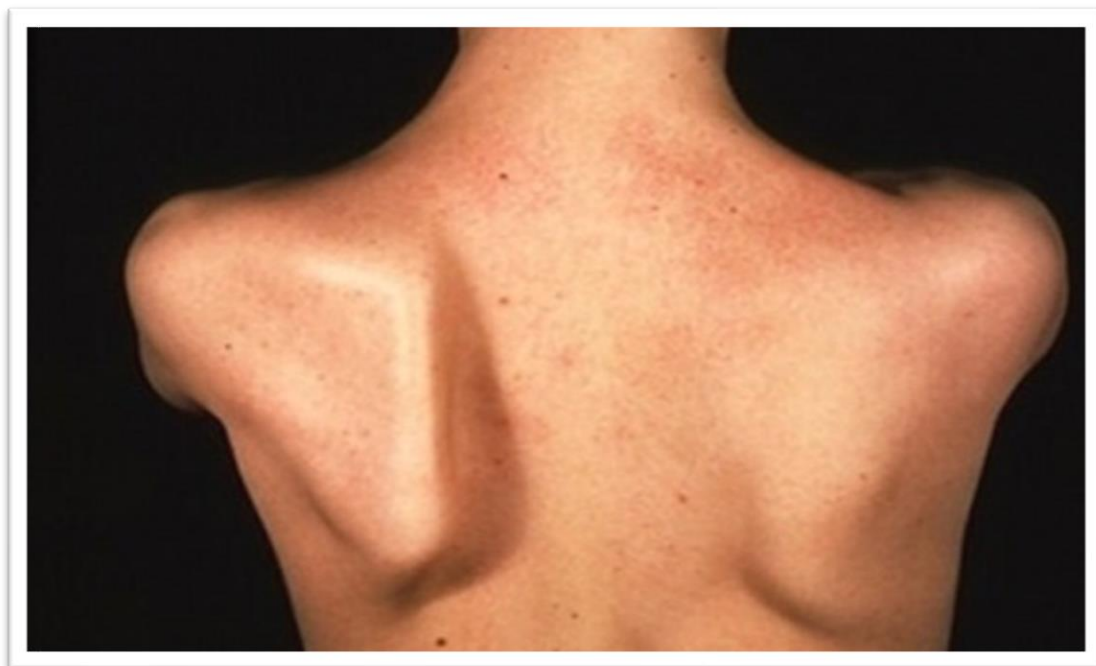
Serratus anterior

Long thoracic nerve (C5-C7)

Serratus
anterior

Often during sport e.g. following a blow to the ribs. Also, possible complication of mastectomy

Damage results in a **winged scapula**



Key 71 A 21 YO male presents complaining of inability to grip objects with his right hand. He has noticed this issue since he had trauma to his hand while playing rugby a few days ago. On examination, the patient cannot flex the distal phalanx of his right ring finger. What is the most likely affected structure?

→ **Flexor digitorum profundus.**

Notes on Fingers Flexors

- Unable to **flex** the "Proximal" interphalangeal joints ± Metacarpophalangeal (MCP) joint →

Flexor Digitorum Superficialis

- Unable to **flex** the “**Distal**” interphalangeal joints →

Flexor Digitorum *profundus*

Key
72

A 55 YO man presents complaining of a neck pain, left arm discomfort and left-hand weakness. On examination, he has weakness in abducting and adducting the fingers of his left hand. MRI reveals a left-sided disc herniation in one area of spinal cord. What is the likely affected nerve root?

→ **T1**

Remember:

C8 radiculopathy

Affects **thumb abduction and extension**, **ulnar deviation of the wrist**, and causes paraesthesia of a thin area on the forearm which runs down to include the little finger.

T1 Radiculopathy

Affects **Fingers Abduction and Adduction**, Pain and Paraesthesia along the affected nerve.

Also Remember:

The motor function of the nerve roots of an upper limb

C5, C6, C7, C8

Flex, extend, extend, flex

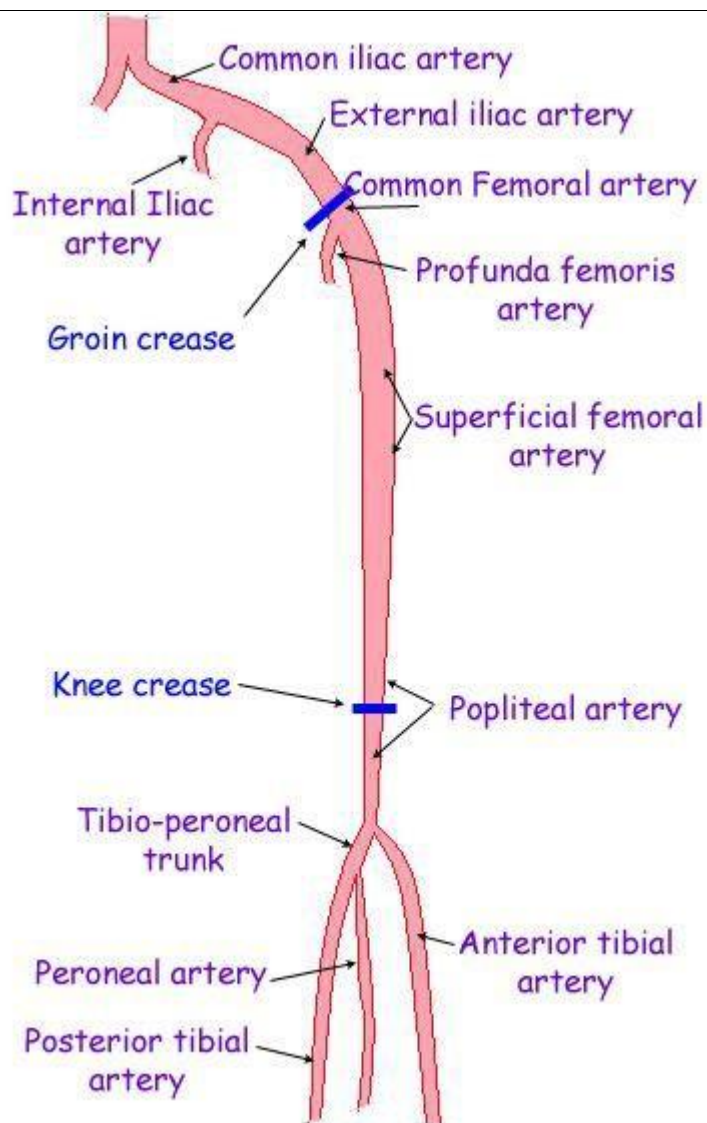
elbow, wrist, elbow, fingers

C5	C6	C7	C8
Flex	Extend	Extend	Flex
elbow	wrist	elbow	Fingers

Adduct and Abduct Fingers → T1

Key
73

The arterial supply of the Lower Limbs:



External iliac → Femoral → Popliteal → Anterior tibial → Dorsalis pedis

(The obstructed artery is always one level proximal “above” the affected muscle group).

Or, one level above the artery that cannot be felt.

Example 1:

An elderly man with a history of smoking and uncontrolled DM presents with pain on calf muscles after walking. He has to rest for a while to be able to continue walking. Popliteal artery and dorsalis pedis cannot be felt.

- The likely occluded artery is → **femoropopliteal artery**.

Example 2:

A patient whose femoral and popliteal pulses are not felt.

- The likely occluded artery → **External iliac artery**.

Claudication pain in Peripheral Arterial Disease**The level of ischemia:**

- ♦ **Aorto-iliac artery occlusion:**

Pain in buttocks, thighs ± Erectile Dysfunction (Leriche Syndrome).

◆ **Common iliac artery occlusion:**

→ pain extends to just above inguinal ligament.

◆ **Femoral artery occlusion:**

→ pain in leg (below inguinal ligament). Femoral pulse is felt but the pulses below it are not felt.

◆ **Femoro-popliteal**

→ Pain is below knee.

Key
74

■ Pregnancy can predispose to **Guyon's canal syndrome**

(**Ulnar** nerve compression at wrist

→ numbness over **little** finger + **half the ring** finger).

■ Pregnancy can predispose to **Carpal tunnel syndrome**

(**Median** nerve compression

→ numbness over **thumb**, **index** and **middle** fingers).

Key
75

A young man fell down on his right shoulder and arm and presents with the following:

Weakness of right shoulder abduction and external rotation.

Numbness over the lateral side of the right arm.

Numbness over the lateral side of the right forearm.

What is the likely affected structure?

Answer:

→ **Upper brachial plexus = superior trunk of the brachial plexus.**

✓ Weakness of right shoulder abduction and external rotation = **axillary nerve = C5, C6.**

✓ Numbness of lateral arm = **axillary nerve = C5, C6.**

✓ Numbness of lateral forearm = **musculocutaneous nerve = C5, C6, C7**

Upper brachial plexus = C5, C6, C7

Lower brachial plexus = C8, T1

Key
76

A young man fell on outstretched arm and was treated surgically.

6 months later, he presents with the following:

✓ Decreased sensation of little finger and medial half of the ring finger.

✓ Wasting of the interosseous muscles.

✓ Inability to cross the two fingers (little + ring) or abduct his little finger.

What is the likely affected structure?

Answer:

→ **Lower brachial plexus = Inferior trunk of the brachial plexus.**

Another correct answer → **Ulnar nerve.**

✓ All given 3 features indicate damage to Ulnar nerve.

✓ Ulnar nerve = C8, T1

✓ C8 and T1 = inferior (lower) trunk of brachial plexus.

Upper brachial plexus = C5, C6, C7

Lower brachial plexus = C8, T1

Remember:

☐ **Ulnar nerve injury (C8, T1):**

◆ **Claw hand + Paraesthesia of little finger + ring finger “ulnar border”.**

◆ The ulnar nerve supplies **dorsal** and **palmar interossei** that are involved in **fingers adduction and abduction** → interosseous muscles wasting, no abduction/ adduction of fingers.

Key
77**Meralgia paresthetica:**

Burning, numbness or tingling sensation of the **lateral thigh** due to injury of → **Lateral femoral cutaneous nerve**.

Key
78

■ Neck injury followed by asymmetrical chest movements:

The injured nerve is → **Phrenic nerve**. “it controls diaphragm”.

Key
79

A 30 YO man has neck pain that radiates to his left shoulder and left middle finger. He also has decreased sensation on his left index and middle fingers. Left arm shows reduced triceps reflex. He also has difficulty straightening his left elbow.

What is the most likely affected nerve root?

[C5 / C6 / **C7** / C8 / T1]

Answer:

- He has reduced **triceps reflex**.

→ Thus, the affected nerve root is either **C7** or **C8**.

- He has a difficulty to straighten “**extend**” his **elbow** → **C7**

Remember from Key 12:**The motor function of the nerve roots of an upper limb**

C5, C6, C7, C8

Flex, extend, extend, flex

elbow, wrist, elbow, fingers

C5	C6	C7	C8
Flex	Extend	Extend	Flex
elbow	wrist	elbow	Fingers

Key
80

Parkinson's disease is a progressive neurodegenerative condition caused by degeneration of dopaminergic neurons in the **substantia nigra** → **Low levels of dopamine** → This results in a classic triad of features: **bradykinesia, resting tremors** and **rigidity**. The symptoms of Parkinson's disease are characteristically asymmetrical.

- In a recent exam, it was asked about the most likely affected anatomical structure in **Parkinson's disease**. The answer was: **Substantia nigra**.
- Patients with Parkinson's disease → impairment of the neurons in the substantia nigra → **Low levels of dopamine**.

Key
81

A 30 YO man sees double vision when he looks to the left side. When he closes either his right or left eye, his vision normalises. What is the likely affected nerve?

- A) Left third cranial nerve.
- B) Left fourth cranial nerve.
- C) Right fourth cranial nerve.
- D) **Left sixth cranial nerve.**
- E) Right sixth cranial nerve.

• **Abducens (6th)**

Diplopia on **Lateral** gaze ((**Same** side). "i.e., **Horizontal Diplopia**"

If he looks at left and sees double → then the lesion is on the left ((**Same** Side)).

Remember O:T:A

O (Oculomotor) 3 rd CN	T (Trochlear) 4 th CN	A (Abducens) 6 th CN
Same side	Opposite side	Same side
Dilated pupil, ptosis	Diplopia on Downgaze The affected muscle → <u>Superior obliques</u> <u>(SO4)</u> . (vertical diplopia)	Diplopia on Lateral gaze

Key
82

After tympanoplasty, a patient developed decreased taste sensation and decreased salivation.

What is the most likely injured nerve?

→ **Facial Nerve (7th CN).**

- **Facial nerve (7th)** innervates the **anterior two-thirds** of the tongue whereas **glossopharyngeal nerve (9th)** innervates the **posterior one-third**.
- **Facial nerve** supplies **sublingual** and **submandibular** glands (salivation).
- Tympanoplasty has the risk to stretch the chorda tympani (which is a branch of the facial nerve).
- Tympanoplasty is the surgical procedure performed to repair a perforated tympanic membrane, with/ without reconstruction of the ossicles, with the aim of preventing reinfection and restoring hearing ability. Microscopic and endoscopic approaches are utilized for tympanoplasty.
- This is usually temporary, and the taste can return several weeks after surgery.

Key
83

A 33-year-old woman has numbness and paraesthesia in her lateral three fingers and a half of the right hand. She finds it difficult to close the buttons of her shirt due to this numbness. Her right hand looks less bulky than the other normal hand. She works at an office job and she has a history of type 2 diabetes mellitus. What is the most likely affected nerve?

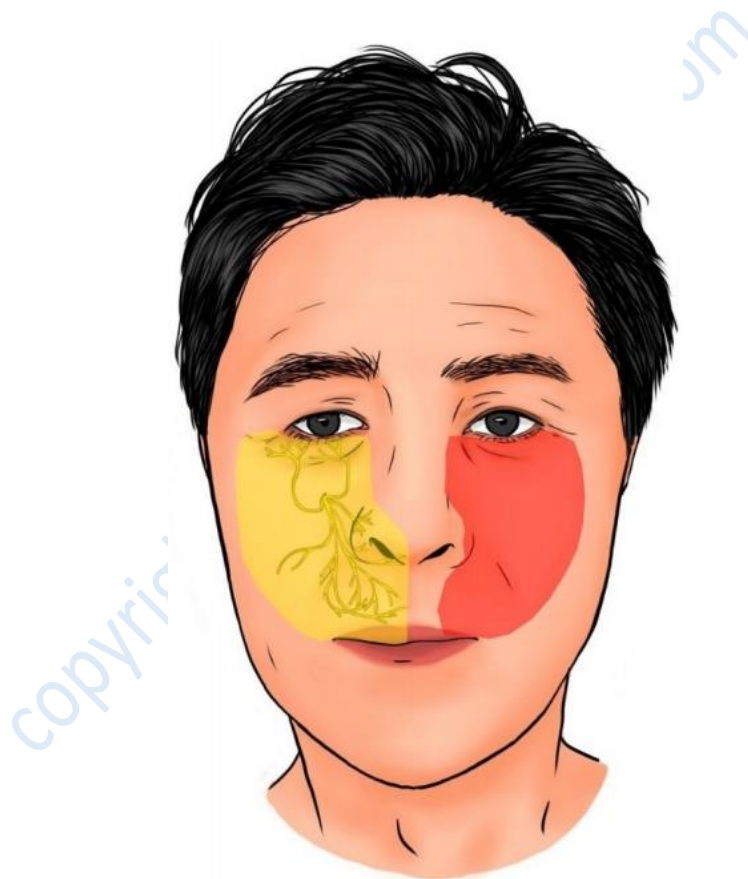
→ **Median nerve.**

Remember that:

- Paraesthesia of the lateral three fingers (thumb, index, MIDDLE) fingers
→ **Median Nerve**. (Nearly the lateral 3 and a half fingers)
 - Paraesthesia of little finger + ring finger (both dorsal and palmar)
→ **Ulnar nerve**
 - Paraesthesia of the dorsal aspect of the THUMB ± a small dorsal area between 1st (Thumb) and 2nd (Index) fingers
→ **Radial Nerve**.
- The risk factors here are: DM and her work nature.
 - Her affected hand looks less bulky because there is wasting in the thenar eminence secondary to median nerve palsy (less bulky, ape-like).

Key
84**Infra-Orbital Nerve**

- It is a branch of Maxillary Nerve, which is a branch of Trigeminal Nerve.
- Its injury (eg, during boxing, orbital blowout fractures) can lead to:
→ Altered sensation or numbness of **cheek, upper lip, and lower eyelid** on the injured side.



Infraorbital nerve distribution

Key
85

The Origin of the Nuclei of the Cranial Nerves (CN Origin)

2,2,4,4

- **Cerebrum** → 2 nuclei → CN I and II. (1 and 2).
- **Midbrain** → 2 nuclei → CN III and IV. (3 and 4).
- **Pons** → 4 nuclei → CN V, VI, VII, VIII. (5, 6, 7 and 8).
- **Medulla** → 4 nuclei → CN IX, X, XI, XII. (9, 10, 11 and 12).

Example:

A man with blurry painful right eye + right eye ptosis, dilated right pupil unresponsive to light + when he looks forwards, the right eye deviates inferiorly and laterally (down and out appearance).

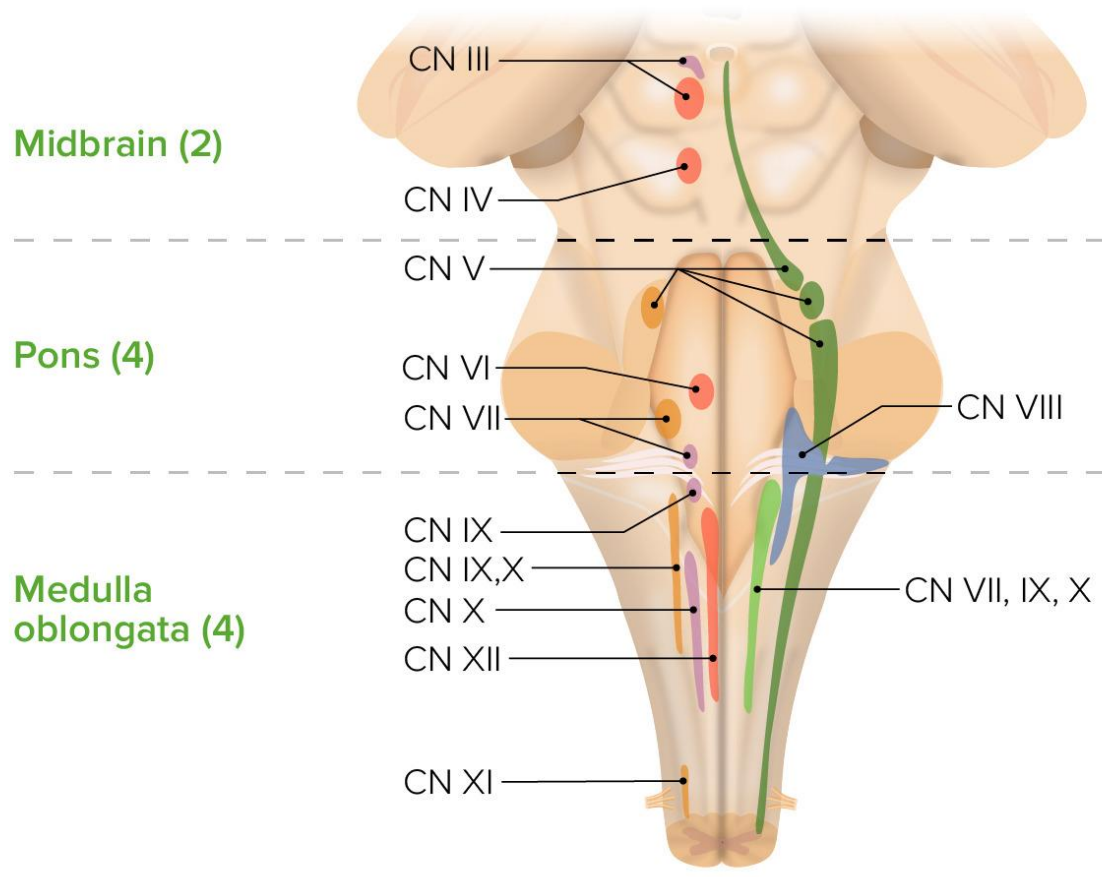
- The likely affected nerve → **Oculomotor nerve (3rd CN)**.
- The likely location of the lesion → **Midbrain**.

☐ Remember **Oculomotor (3rd)**

✓ Its injury leads to → **Dilated pupil (Mydriasis)**, **Ptosis** (On the **Same** side),

Others: outward gaze, diplopia.

Also, in **3rd nerve palsy** → down and out appearance (on looking forwards, the affected eye deviated **inferiorly** and **laterally**).



Key
86**T1 Radiculopathy:**

- Numbness of the **medial aspect** of the **upper arm** (ipsilateral).
- Weakness of the **hand** (ipsilateral).
- Difficulty to **abduct** and **adduct fingers** (ipsilateral).

Scenario:

A man presents with neck pain, right arm discomfort, right hand weakness, numbness and tingling over the medial aspect of the upper right arm, and weakness in right fingers abduction and adduction.

The likely affected nerve root → **T1**.

The motor function of the nerve roots of an upper limb

C5	C6	C7	C8
Flex	Extend	Extend	Flex
elbow	wrist	elbow	Fingers

Adduct and Abduct Fingers → **T1**

Key
87

A man had ankle injury and had below-knee cast that extends to the top of the foot. A few weeks later, the cast had been removed. However, he is now unable to **dorsiflex** his foot.

→ Inability to Dorsiflex → Foot Drop → **Common peroneal nerve injury**.

Key
88

Gradenigo's Syndrome:

3 Features develop due to Otitis Media + Mastoiditis of petrous bone:

- 1) **Ear discharge**; otorrhea (Otitis Media).
- 2) **Facial** or retro-orbital **pain**.
- 3) **Horizontal diplopia** (due to **Abducens nerve**; ie, 6th CN involvement).

Gradenigo's Syndrome → **E, F, E**

Ear → discharge (otitis media) | **F**ace → Pain. | **E**ye → diplopia (abducens n).



It is important to remember which nerve is involved (**abducens**).

Also, Remember: **O:T:A**

O (Oculomotor) 3 rd CN	T (Trochlear) 4 th CN	A (Abducens) 6 th CN
Same side	Opposite side	Same side
Dilated pupil, ptosis	Diplopia on Downgaze	Diplopia on Lateral gaze

Key 89 A 40-year-old man had a saw cut on his left middle finger. He is unable to flex the proximal interphalangeal joint of his finger but able to flex the distal interphalangeal joint. What is the most likely teared tendon?

→ **Flexor Digitorum Superficialis**.

Notes on Fingers Flexors

- Unable to **flex** the “**Proximal**” interphalangeal (IP) joints AND Metacarpophalangeal (**MCP**) joint, but able to flex the distal IP joint →

Flexor Digitorum Superficialis.

- Unable to **flex** the “**Distal**” interphalangeal joints →

Flexor Digitorum profundus.

Key
90

Intercostalbrachial Neuralgia

- ✓ Sharp, burning, or aching pain that radiates from axilla to the medial aspect of the upper arm.
- ✓ It usually results from surgery (eg, breast surgery, axillary nodes dissection), trauma, or other pathologies (eg, herpes zoster, thoracic outlet syndrome) that affect the **intercostalbrachial** nerves.
- ✓ The usually involved dermatome is → (**T2**).

Key
91

An Important Complication of Tympanoplasty

- Tympanoplasty is the surgical procedure performed to repair a perforated tympanic membrane when it does not heal and close on its own, with or without reconstruction of the ossicles (ossiculoplasty), aiming to prevent reinfection and restore hearing ability.
- **One of the possible important complications of tympanoplasty is:**
→ **Facial Nerve (CN VII) Injury** → Decreased (↓) **Taste sensation** and **Salivation**.

Remember, Loss of Taste Sensation:

- ✓ Anterior 2/3rd of the tongue: **Facial Nerve (7th CN)**.
- ✓ Posterior 1/3rd of the tongue: **Glossopharyngeal (9th CN)**.

Key
92

Eye Muscle Palsies: Superior Oblique vs Lateral Rectus

Superior Oblique Muscle (SO4):

- **Scenario:** A patient has difficulty **moving the eye downward**, particularly when **adducted**, causing **double vision** when looking down (e.g., **reading** or **walking downstairs**). Tilting the head slightly may improve the symptoms.
- **Nerve Supply:** **Trochlear nerve** (CN **IV**).
- **Side of Diplopia:** Diplopia occurs on the **opposite** side of the affected muscle (due to the crossing nature of the trochlear nerve fibers).
- **Mnemonic:** "SO4" (Superior Oblique is innervated by Cranial Nerve IV).

Lateral Rectus Muscle (LR6):

- **Scenario:** A patient experiences **double vision** when trying to look **outward** (**laterally**). The affected eye cannot move outward, particularly when attempting lateral gaze.
- **Nerve Supply:** **Abducens nerve** (CN **VI**).

- **Side of Diplopia:** Diplopia occurs on the same side as the affected muscle (since the abducens nerve directly innervates the lateral rectus on the same side).

- **Mnemonic:** "LR6" (Lateral Rectus is innervated by Cranial Nerve VI).

■ **Combined Mnemonic:**

"SO4 LR6" - Superior Oblique (CN IV), Lateral Rectus (CN VI).

Key
93

Common Peroneal Nerve Injury: Presentation and Diagnosis

A 35-year-old woman reports difficulty lifting her foot and turning it outward while walking, with the symptoms starting after she tripped over a curb two weeks ago. Upon examination, there is weakness in **dorsiflexion** (the ability to lift the foot upwards) and **eversion** (the ability to turn the sole of the foot outward). She also experiences numbness on the top of her foot and along the outer part of her shin. No issues with her knee or thigh are noted. Which nerve is most likely affected?

■ **Answer →** Common Peroneal Nerve Injury (or: Peroneal Nerve).

- **Nerve Involved:** Common Peroneal Nerve, a branch of the sciatic nerve.
- **Functions Affected:**
 - **Dorsiflexion:** Lifting the foot upwards.
 - **Eversion:** Turning the sole of the foot outward.
- **Symptoms:**
 - Difficulty lifting the foot (difficulty in foot **Dorsiflexion**), leading to **foot drop** (inability to raise the front part of the foot while walking).
 - **Weakness in eversion** (turning the foot outward).
 - Numbness or **reduced sensation over the dorsal aspect (top) of the foot and the lateral shin** (outer side of the lower leg).
- **Mechanism of Injury:** Often due to trauma, such as tripping, which can compress or damage the nerve.
- **Key Point:** Damage to the common peroneal nerve leads to both motor (movement) deficits, such as foot drop, and sensory loss in the areas it supplies.

Key
94

Anatomical Leak Sites in Gastric Ulcer Perforations

- **Posterior Gastric Ulcer Perforation:**
 - Gastric contents leak into the **lesser sac**, which is a smaller compartment located behind the stomach.
 - This type of perforation is less likely to cause diffuse peritonitis but can still lead to localized infection and inflammation.
- **Anterior Gastric Ulcer Perforation:**
 - Gastric contents leak into the **greater sac**, which is the main part of the peritoneal cavity (ie, **general peritoneal cavity**).
 - This results in more widespread contamination, often causing **diffuse peritonitis**, a severe and life-threatening inflammation of the abdominal lining.